MOTOROLA

*Personal Communications Sector*

# T200 / T2688

## GSM Service Support

*Training - Documentation - Engineering*

# Level 1 & 2
# Service Manual

**Rev 1.2**

# CONTENTS


**Page Number**

## SECTION 1: GENERAL

| | | |
|---|---|---|
| 1.1 | Introduction | v |
| 1.2 | Motorola service policy for T200 in warranty | vi |
| 1.3 | General Safety Information | vii |

## SECTION 2: T200 DESCRIPTION

| | | |
|---|---|---|
| 2.1 | Specifications of T200 | 2 |
| 2.2 | T200 Overview | 3 |
| 2.3 | Connector Pinout | 6 |
| 2.4 | Talk time, Weight and Volume Matrix | 6 |
| 2.5 | Battery Charging Times | 8 |

## SECTION 3: FEATURE LIST

| | | |
|---|---|---|
| 3.1 | List of Features available | 9 |
| 3.2 | Menu | 9 |
| 3.3 | Phone Book | 9 |
| 3.4 | Messages | 10 |
| 3.5 | Call Services | 11 |
| 3.6 | Phone Settings | 12 |
| 3.7 | Networks | 12 |
| 3.8 | Security | 13 |
| 3.9 | Audio Settings | 13 |
| 3.10 | Tools | 14 |

## SECTION 4: DISASSEMBLY & PARTS

| | | |
|---|---|---|
| 4.1 | Dissasembly Introduction | 16 |
| 4.2 | Recommended Tools | 16 |
| 4.3 | Disassembly Procedure | 16 |
| 4.4 | Assembly procedure | 16 |
| 4.5 | Exploded Parts diagram | 19 |
| 4.6 | Part Numbers | 20 |

## SECTION 5: SIM CARDS AND SECURITY

| | | |
|---|---|---|
| 5.1 | Manual test mode | 42 |
| 5.2 | Live Sim Card | 42 |
| 5.3 | Personality Transfer | 42 |
| 5.4 | GSM Test Command | 44 |
| 5.5 | Identity and Security | 45 |

## SECTION 6: REPAIR & TEST PROCEDURES


| | | |
|---|---|---|
| 6.1 | Repair introduction | 26 |
| 6.2 | Mechanical repairs | 26 |
| 6.3 | Basic modular troubleshooting | 26 |
| 6.4 | Software Upgrade | 28 |
| 6.5 | Flexing | 28 |
| 6.6 | Testing on DM Tools | 29 |


## SECTION 7: ACCESSORIES


| | | |
|---|---|---|
| 7.1 | Accessory Introduction | 35 |


## SECTION 8: SALES MODELS


| | | |
|---|---|---|
| 8.1 | Sales Models Numbers | 37 |


## SECTION 9: GLOSSARY OF TERMS


| | | |
|---|---|---|
| 9.1 | List of Abbreviations | 41 |

# SECTION 1: GENERAL

## 1.1 Introduction

This manual is intended for use by technicians familiar with similar types of equipment. It contains all service information required for the equipment described and is current as of the printing date. This manual is intended for use with the T200. The T200 is electrically and physically identical to the Asian model the T2688.

The scope of this document is to provide the reader with basic information relating to the T200, and also to provide procedures and processes for repairing the units up to and including Level 2 repair. That is a repair that does not involve any soldering.

Level 1 and 2 repairs involve the following activities that can be carried out: -

- Unit swap out
- Repairing of mechanical faults
- Basic modular troubleshooting
- Testing and verification of unit functionality
- Upgrading software
- Flexing of product
- Initiate warranty claims and send faulty modules to Level 3 or 4 repair centres.

Computer Software Copyrights

The Motorola products described in this instruction manual may include copyrighted Motorola computer programs stored in semi-conductor memories or other media. Laws in the United States and other countries preserve for Motorola certain exclusive rights for copyrighted computer programs, including the exclusive right to copy or reproduce in any form the copyrighted computer program. Accordingly, any copyrighted Motorola computer programs contained in the Motorola products described in this instruction manual may not be copied or reproduced in any manner without the express written permission of Motorola. Furthermore, the purchase of Motorola products shall not be deemed to grant either directly or by implication, estoppel, or otherwise, any license under the copyrights, patents or patent applications of Motorola, except for the normal non-exclusive, royalty free license to use that arises by operation of law in the sale of a product.

## 1.2 Motorola Service Policy for T200 in warranty

### 1.2.1 Warranty:

Product will be sold with the standard 12 months warranty terms and conditions. Accidental damage misuse, retailers extended warranties will not be supported under warranty. Non warranty repairs will be available at agreed fixed repair prices.
Proof of purchase will be required to validate warranty claims.

### 1.2.2 Out of Box Failure Policy

The standard OOB failure criteria will apply. Customer units that fail very early on, after date of sale, are to be returned to Manufacturing for root cause analysis, to guard against epidemic criteria. Manufacturing to bear the costs of early life failure.

### 1.2.3 Product Support

Customers original units will be repaired but not refurbished as standard. Appointed Motorola Service Hubs will perform warranty and non-warranty field service for level 2 (assemblies) and level 3 (limited PCB component). The Motorola HTC centres will perform level 4 (full component) repairs.

### 1.2.4 Customer Support:

This will be available through dedicated Call Centres and In Country Help Desks.
Product Service training should be arranged through the local Motorola Support Centre.

### 1.2.5 Replacement Parts Ordering

Only centres authorized to carry out repairs will be able to purchase spare parts. Orders for spare parts from Hub’s and Hi-Tech Centres should be placed with the regional Motorola Parts Distribution Centre.

## 1.3 General Safety Information

### 1.3.1 Portable Operation

- DO NOT hold the radio so that the antenna is very close to, or touching, exposed parts of the body, especially the face or eyes whilst transmitting. The radio will perform best if it is held in the same manner as you would hold a 'land' telephone handset, with the antenna angled up and over your shoulder.

- DO NOT operate the portable phone in an aircraft. Switch off your telephone. The use of a cellular telephone in an aircraft may be dangerous to the operation of the aircraft, disruption of the Cellular Network may occur, and is illegal. Failure to observe this instruction may lead to a suspension or denial of Cellular Telephone Service to the offender, or legal action, or both.

### 1.3.2 Mobile/Portable Operation - Telephone use in Vehicles:

- All equipment must be properly grounded according to installation instructions for safe operation.

- Users are advised to turn off their equipment when at a refueling point.

- Safety is every driver's responsibility. Cellular telephones should only be used in situations in which the driver considers it safe to do so.

### 1.3.3 General

- DO NOT allow children to play with any radio equipment containing a transmitter.

- DO NOT operate this equipment near electrical blasting caps or in an explosive atmosphere. Mobile Telephones are, under certain conditions, capable of interfering with blasting operations. When you are in the vicinity of such work, look out for and observe signs cautioning against mobile radio transmission. If transmission is prohibited, you must turn off your mobile telephone to prevent any transmission.
  In standby mode the mobile telephone will automatically transmit to acknowledge a call if it is not turned off.

- Refer to the appropriate section of the product user manual for additional pertinent safety information

- All equipment should be serviced only by a Motorola qualified technician.

# SECTION 2:
# T200
# DESCRIPTION

## 2.1 Specifications of T200

General

| ***Function*** | **Specification** |
|---|---|
| Frequency Range GSM<br><br>Frequency Range DCS | 890-915 MHz TX<br>915-960 MHz RX<br>1710-1785 MHz Tx<br>1805-1880 MHz Rx |
| Channel Spacing | 200 kHz |
| Channels | 124GSM/374 DCS carriers with 8 channels per carrier |
| Modulation | GMSK at BT = 0.3 |
| Transmitter Phase Accuracy | 5 Degrees RMS, 20 Degrees peak |
| Duplex Spacing | 45 MHz GSM 95MHz DCS |
| Frequency Stability | ± 0.10 ppm of the (Uplink TX) |
| Operating Voltage | Battery Operating Voltage 2.7V – 4.2V (Li-Ion)<br>3.3V – 4.2V (NiMH) |
| Transmit Current | Typically 250 ma avg, 1.0A peak |
| Stand-by Current | Typically 7.0 ma (DRX2) |
| Dimensions | 112mm x 46mm x 18.5mm |
| Size (Volume) | 78cc |
| Weight | 90g with Battery |
| Temperature Range | -20C to +55C |

Transmitter

| ***Function*** | ***Specification*** |
|---|---|
| RF Power Output | 33 dBm ± 2dB GSM/ 30 dBm ± 2 dB DCS |
| Output Impedance | 50 ohms (nominal) |
| Spurious Emissions | -36 dBm from 0.1 to 1 Ghz<br>-30 dBm from 1 to 4 Ghz |

Receiver

| ***Function*** | ***Specification*** |
|---|---|
| RF Level | <-120 dBm GSM <-100 dBm DCS |
| RX bit error rate (100 k bits) | < 2% |
| Channel Hop Time | 500 microseconds |
| Time to Camp | Approximately 5-10 seconds |

Speech Coding

| ***Function*** | ***Specification*** |
|---|---|
| Speech Coding Type | Regular Pulse Excitation / Linear Predictive Coding with Long Term Prediction. (RPE LPC with LTP). |
| Bit Rate | 13.0 k bps |
| Frame Duration | 20 ms |
| Block Length | 260 bits |
| Classes | Class 1 bits = 182 bits. Class 2 bits = 78 bits |
| Bit Rate with FEC Encoding | 22.8 k bps |

## 2.2 T200 Overview

The T200 is of the Dual Band technology range allowing roaming using the GSM 900 / 1800 bands. The unit is an OEM product, and is the same product, mechanicaly and physically as the Asian T2688. The unit will still be marketed within the Talkabout brand;

**TalkAbout positioning statement:**

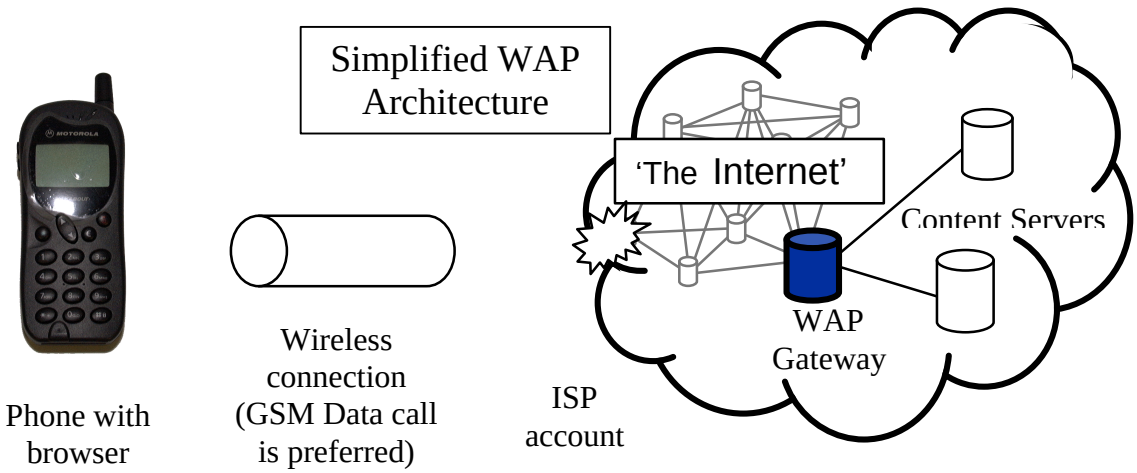
*"For those who want to stay in touch with friends and family within their busy lives, Motorola provides mobile communications products that provide the peace of mind of staying connected to those important to you, even when you're apart, with hassle free features designed specifically for personal connections."*

The following are a few of the main selling features that will be included with the unit.

- New, slim and light form factor
- SMS arriving indication
- SMS overflow indication
- Voice Mail arriving indication
- SMS Cell Broadcast
- CLI presentation
- Date and time stamp for last 10 calls
- USSD MO and Network Originated ALS
- Calendar
- Vibrator
- Phone book holds 100 entries in memory and another 120 in the SIM Card
- New animatated graphics
- Calender & Calculator functions
- Vibracall™
- WAP 1.1. compliant
- Calling Name Presentation
- New Ringer Tones

**Phase 2 USSD (Unstructured Supplementary Services Data)** – This is an application whereby pressing a certain key or combination of keys whilst in idle mode ie not in a call can access certain network functions such as helplines etc...

- **WAP 1.1 Compliancy (Wireless Application Protocol) - WAP 1.1** Wireless Application Protocol



- In the WAP environment this is how the access is made.

1. The request for information is made in WML (Wireless Markup Language) derived from HTML.
2. Request is passed to WAP Gateway, which retrieves the information from the server in standard HTML (which is then filtered to WML) or if available WML format.
3. The information is then passed the cellular user, via the cellular network provider.

- There will be 5 Data parameters that the user will be able to edit:
  -Baud rate - between 2400 and 14400
  -Idle time out
  -Line type
  -Phone Number
  -Connection type

- For image download, the bitmap image will be downloaded as text and if the image is larger than the screen then only part of the image will be displayed

- Ways to access Browser - Quick access key and Feature Menu

During browser mode, if incoming call is received then the browser will be paused with the user having the option to resume after the call.

**Calling Name Presentation -** This is an improvement on the existing name presentation.

- At present name from phone book is displayed by comparing last 8 digits of Number
- New feature will show name as sent by the network. This is up to 80 characters, but will be shortened to 12 for the phonebook.
- This functionality must be subscribed to with network.
- Caller can restrict this
- On call arrival phone Number is compared to phonebook if match is found but name is not allocated then callers name will be stored.(However if there is any text against that number it will not be overwritten)

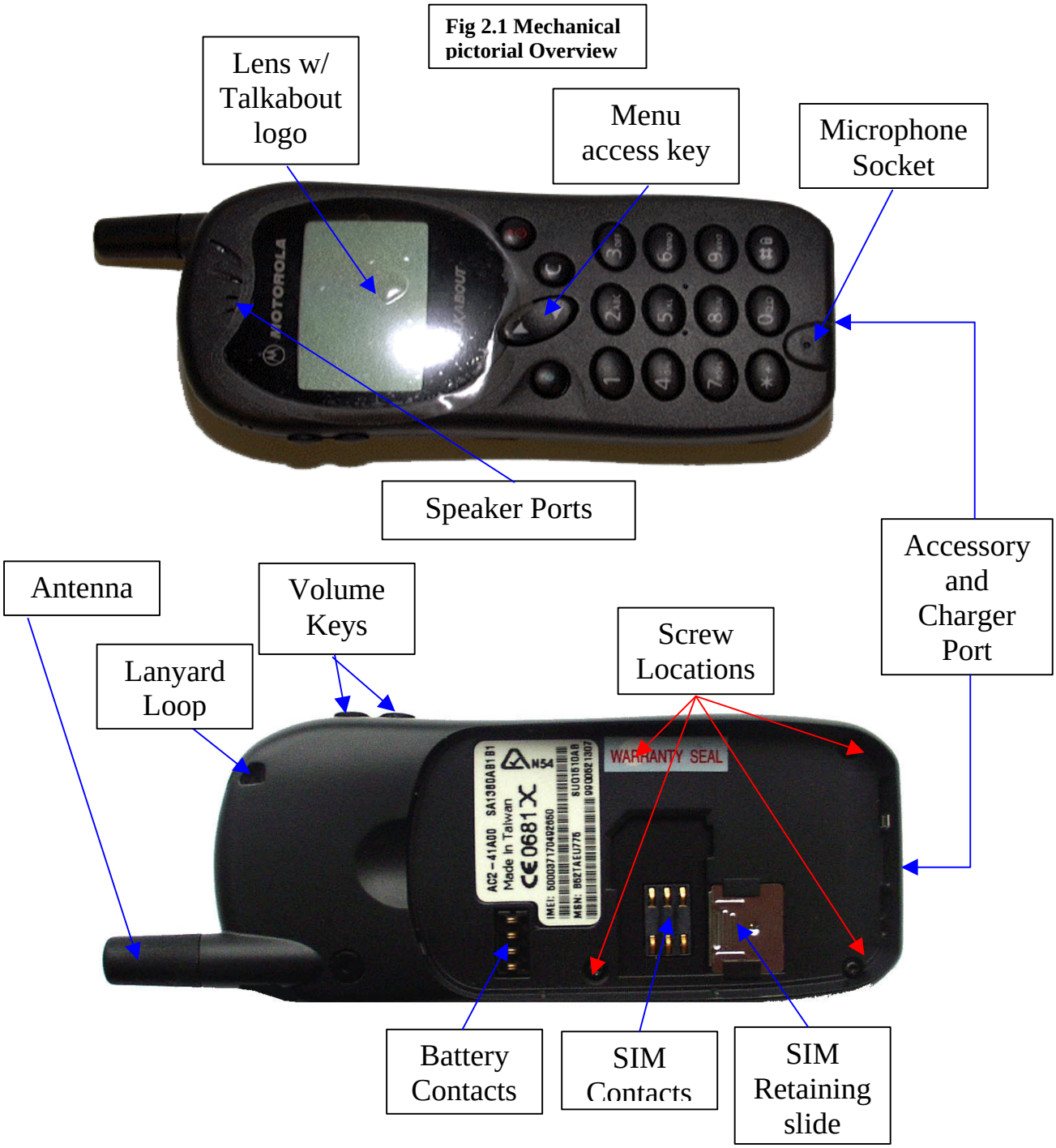
**Display Animation -** Aimed at physically showing the customer is executing commands.
Existing animations are for Power up and Down sequences.

- New animations -
- Incoming / sending call
- Incoming / sending SMS
- WAP Browsing

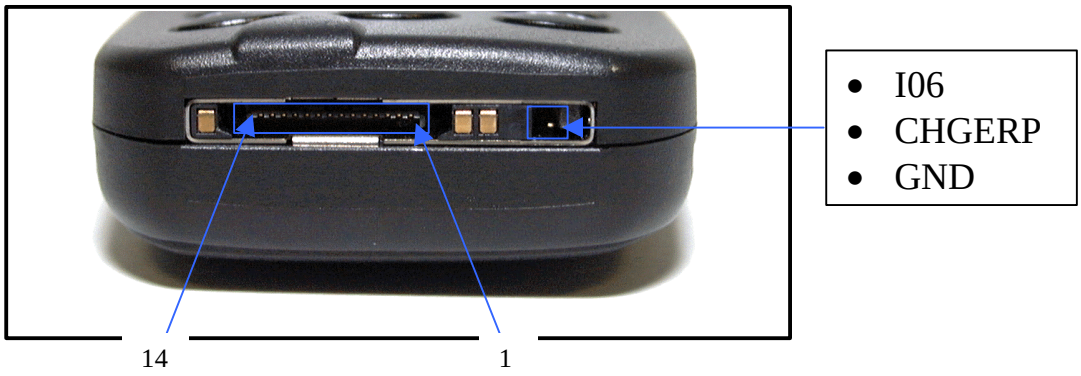
**Call Divert Interrogation -** This function is just a more accurate way of ensuring that the caller is diverted to the correct number, this is mainly achieved through the co-operation of the network providers.

**Connectivity –** The t200 supports Windows 95 / 98 / NT in data service. No PCMCIA card is required

**Fig 2.1 Mechanical pictorial Overview**



### 2.3 Connector Pinouts




**Charger Socket Pin Layout**

| | |
|---|---|
| 1.Ext AUD MIC IN / JTAG TMS Use | 2.JTAG TRST Use |
| 3.GND / JTAG TMK Use | 4.Auxiliary Audio Out / JTAG TDI |
| 5.RS232 – DSR | 6.RS232_RXD |
| 7.RS232_TXD | 8.RS232 - DTR |
| 9.DATA ID | 10.I06 / JTAG TDO Use |
| 11.IOPN11 – EXT. Power | 12.ACCID – Accessory ID |
| 13.ACCIN | 14.GND |

### 2.4 Talk Times, Weight and Volume Matrix

| Volume (cc) | Weight (g) | Talk Time (min)* | Standby Time (hours)* | with Battery |
|---|---|---|---|---|
| 78 cc | 90 g | 152-376 | 70-92 | 600 mAh LiIon |
| 87cc | 104g | 164-408 | 76-99 | 650mAh Ni MH |
| 86cc | 107g | 228-565 | 105-138 | 900 mAh LiIon |

**All battery performance times are approximate and will vary depending on network configuration, band and status, and the functions selected. Times are quoted as a range from DRX=2 to DRX=9. Support of DTX mode is dependent on network support and may not be available in all areas.**

### 2.5 Battery Charging Times

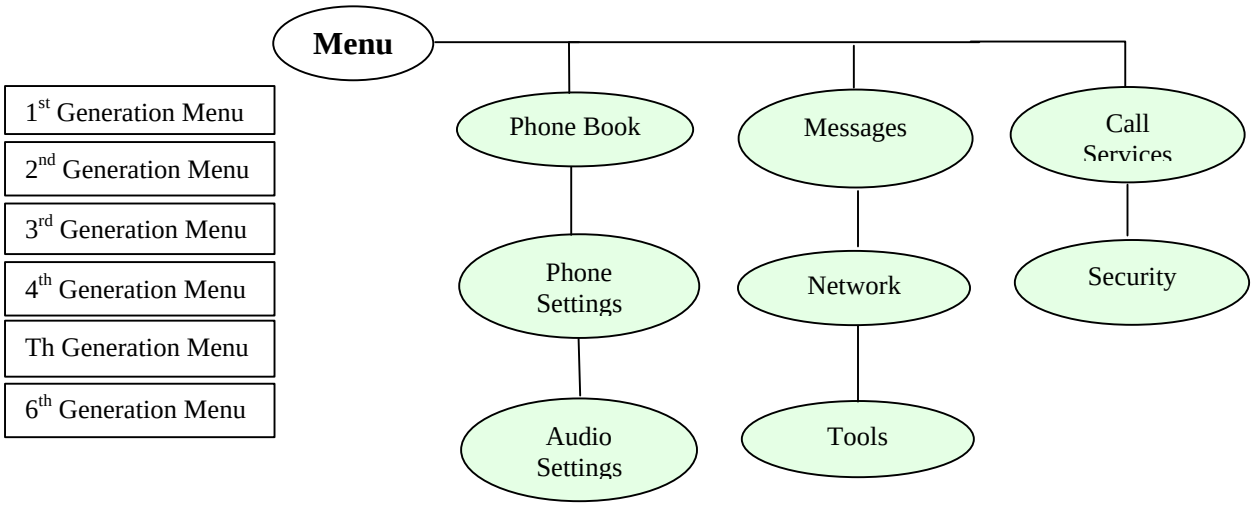
**Identical to Leap, maximum charge times shown.**

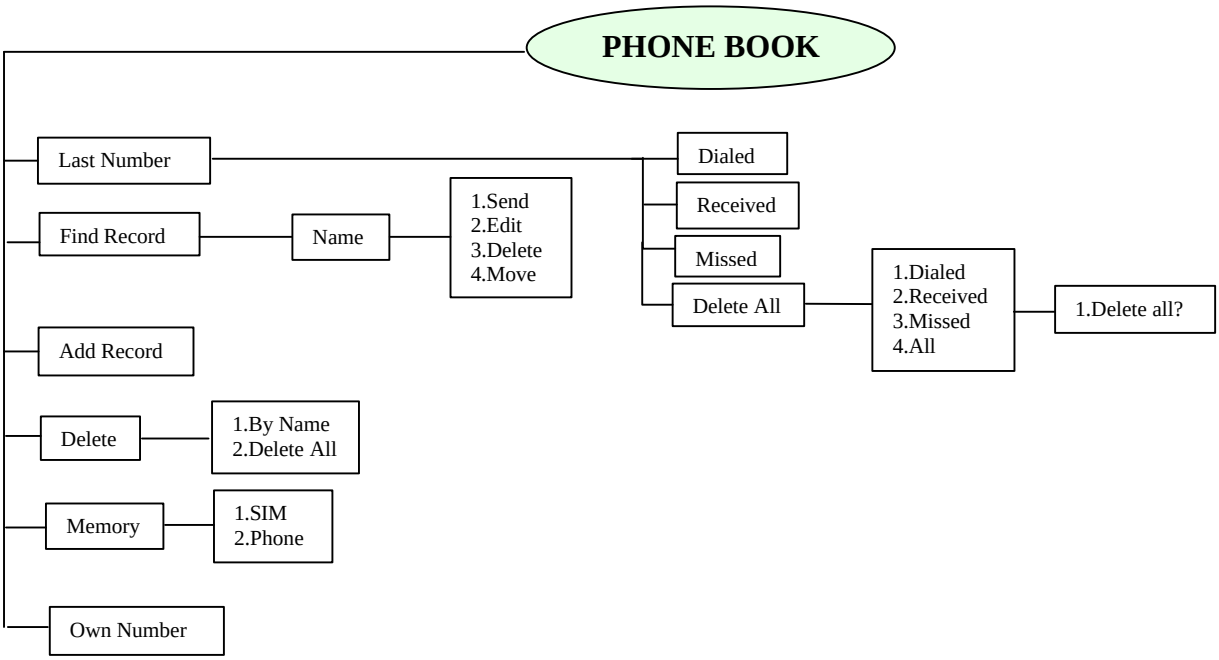
| Battery | Charge time with Switch Mode Travel charger to 95% | Charge time with Linear Travel charger to 95% |
|---|---|---|
| 600 mAh LiIon | 95 minutes | 160 minutes |
| 650mAh Ni MH | 175 minutes | 210 minutes |
| 900 mAh LiIon | 220 minutes | 260 minutes |

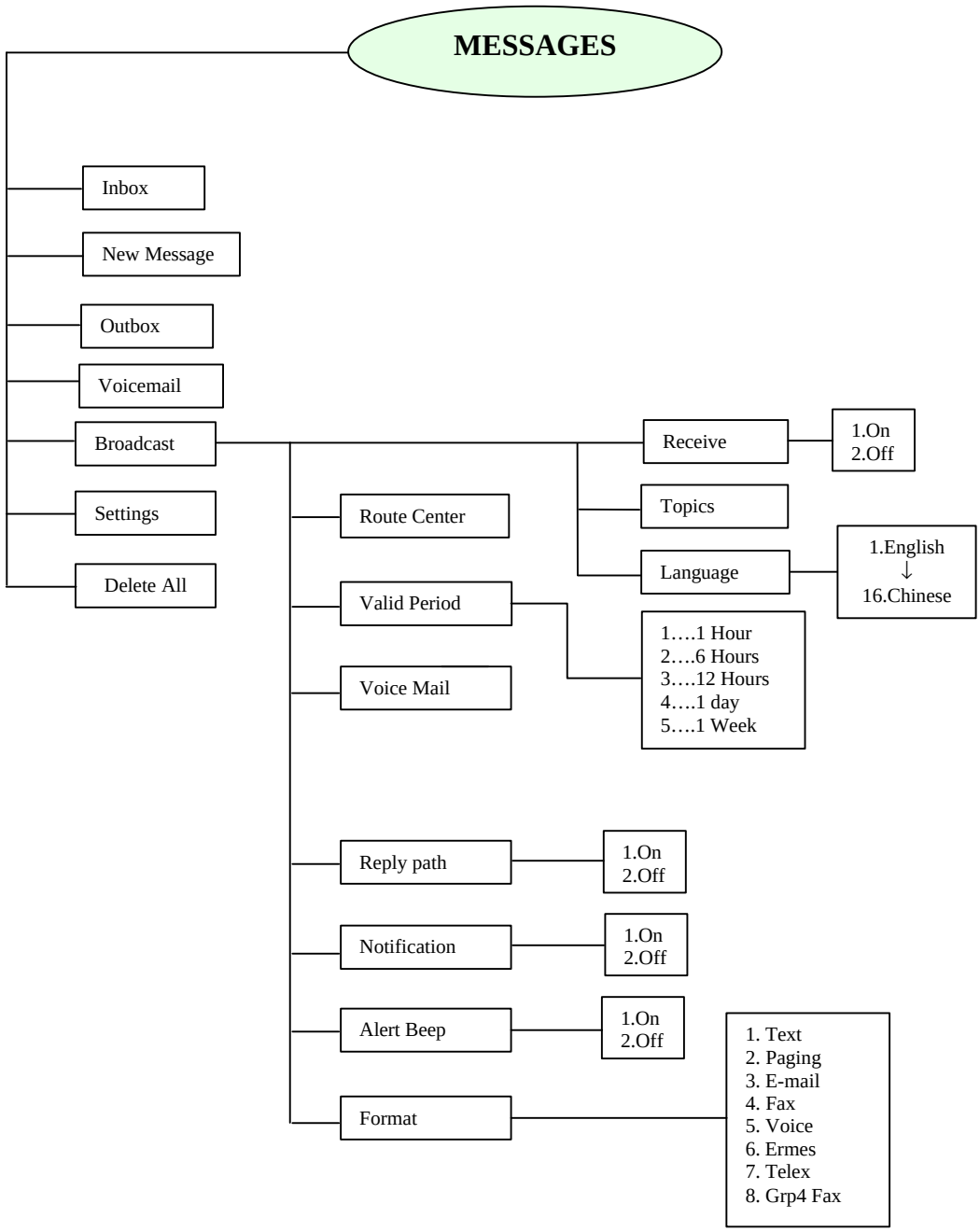
# SECTION 3: FEATURE LIST

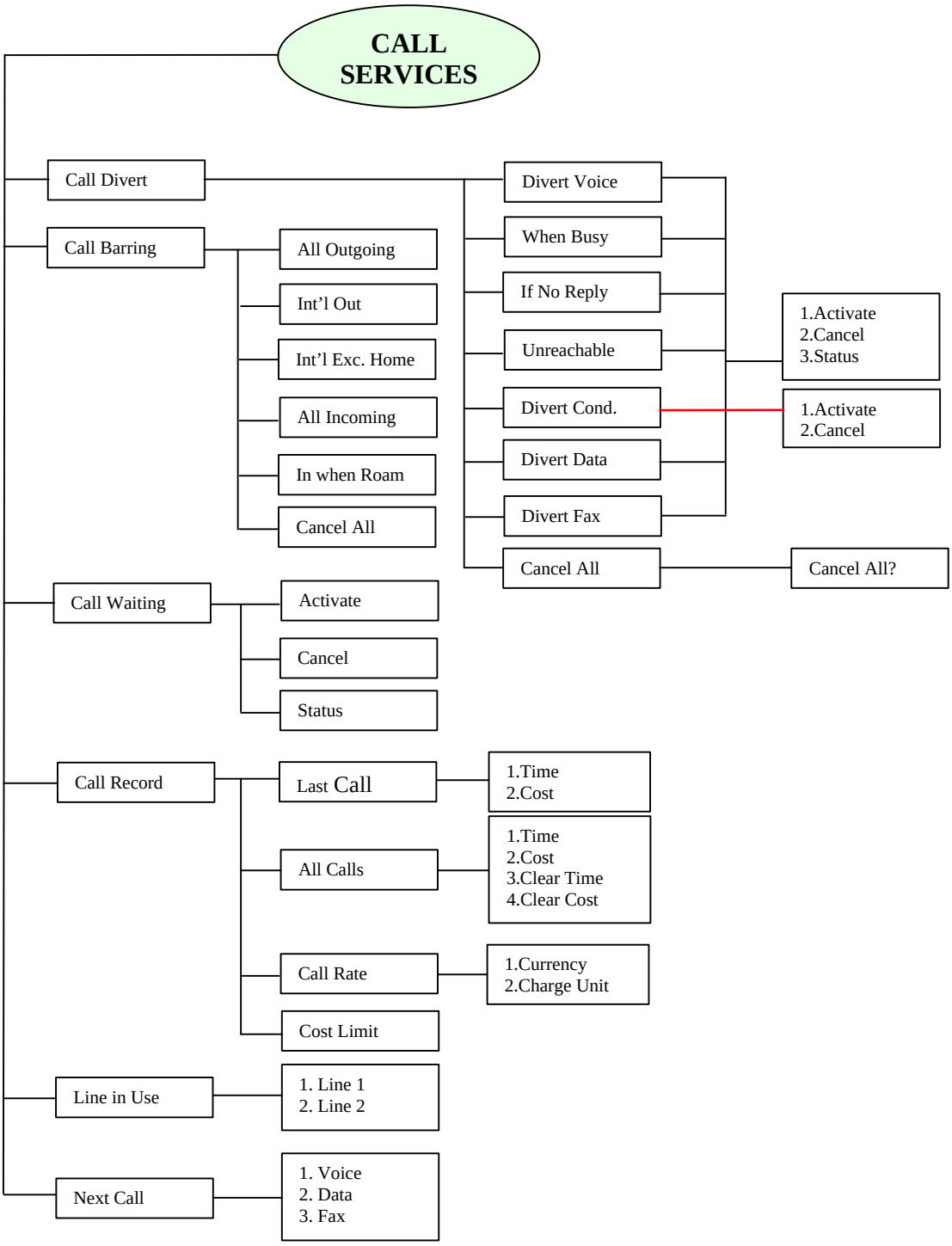
## 3.1 List of Features Available

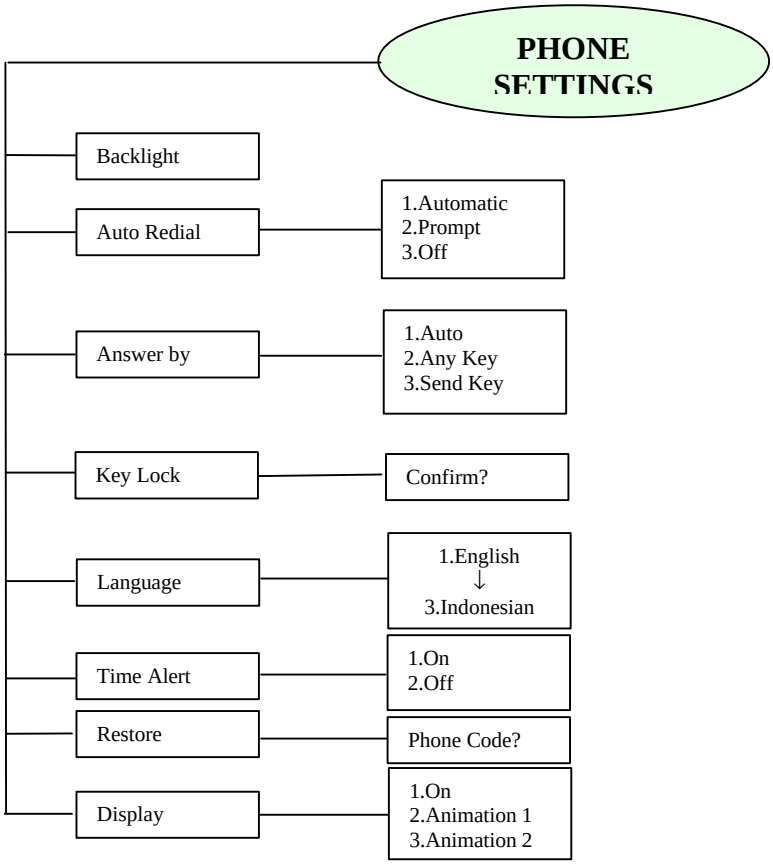
Below is the list of Menu functions available at present. Pressing the following key can access the menu option:

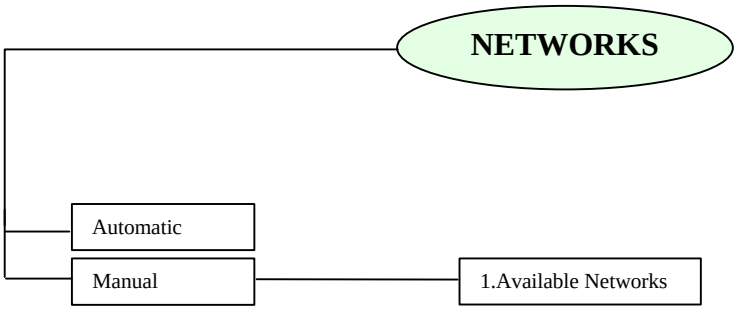


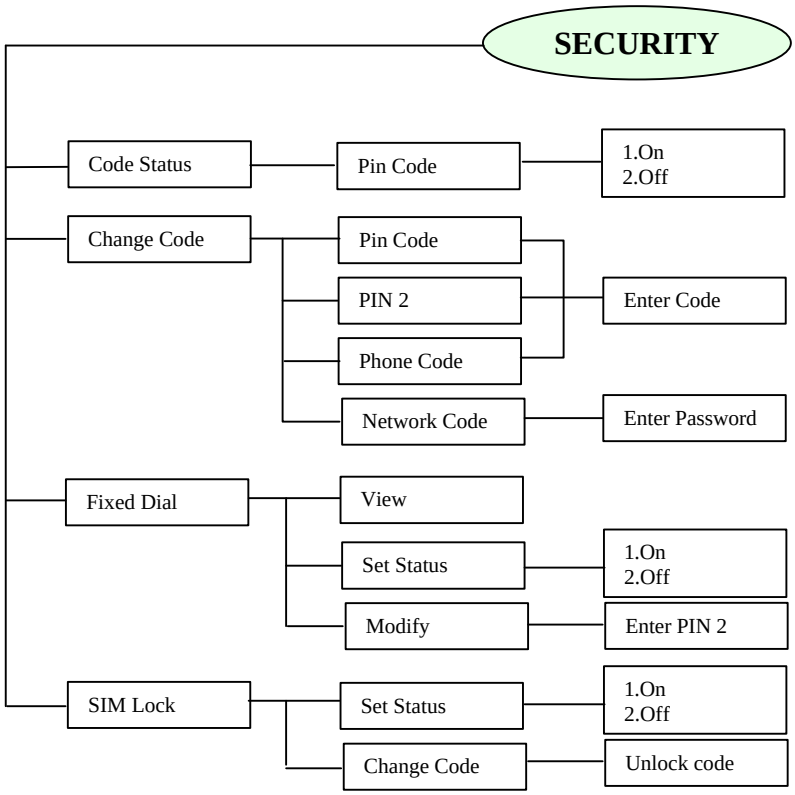

MESSAGES
Inbox
New Message
Outbox
Voicemail
Broadcast
Settings
Delete All
Receive
1.On
2.Off
Topics
Language
1.English
↓
16.Chinese
Route Center
Valid Period
1….1 Hour
2….6 Hours
3….12 Hours
4….1 day
5….1 Week
Voice Mail
Reply path
1.On
2.Off
Notification
1.On
2.Off
Alert Beep
1.On
2.Off
Format
1. Text
2. Paging
3. E-mail
4. Fax
5. Voice
6. Ermes
7. Telex
8. Grp4 Fax

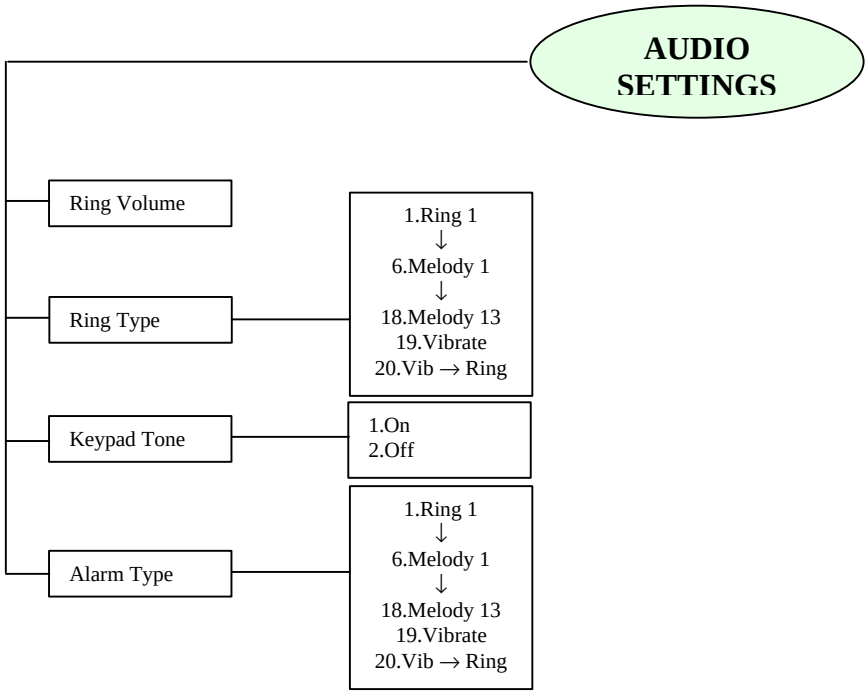

CALL SERVICES
Call Divert
Call Barring
Call Waiting
Call Record
Line in Use
Next Call
All Outgoing
Int'l Out
Int'l Exc. Home
All Incoming
In when Roam
Cancel All
Activate
Cancel
Status
Last Call
All Calls
Call Rate
Cost Limit
1.Time
2.Cost
1.Time
2.Cost
3.Clear Time
4.Clear Cost
1.Currency
2.Charge Unit
1. Line 1
2. Line 2
1. Voice
2. Data
3. Fax
Divert Voice
When Busy
If No Reply
Unreachable
Divert Cond.
Divert Data
Divert Fax
Cancel All
1.Activate
2.Cancel
3.Status
1.Activate
2.Cancel
Cancel All?

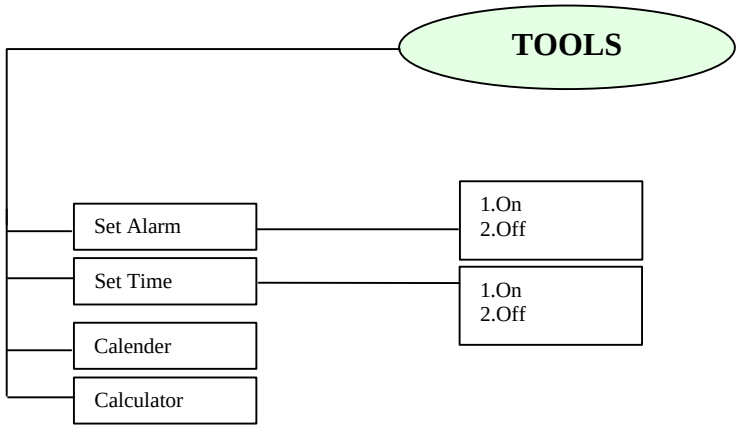

PHONE SETTINGS
Backlight
Auto Redial
1.Automatic
2.Prompt
3.Off
Answer by
1.Auto
2.Any Key
3.Send Key
Key Lock
Confirm?
Language
1.English
↓
3.Indonesian
Time Alert
1.On
2.Off
Restore
Phone Code?
Display
1.On
2.Animation 1
3.Animation 2


NETWORKS
Automatic
Manual
1.Available Networks

=


SECURITY
Code Status
Pin Code
1.On
2.Off
Change Code
Pin Code
PIN 2
Phone Code
Enter Code
Network Code
Enter Password
Fixed Dial
View
Set Status
1.On
2.Off
Modify
Enter PIN 2
SIM Lock
Set Status
1.On
2.Off
Change Code
Unlock code


AUDIO SETTINGS
Ring Volume
Ring Type
1.Ring 1
↓
6.Melody 1
↓
18.Melody 13
19.Vibrate
20.Vib → Ring
Keypad Tone
1.On
2.Off
Alarm Type
1.Ring 1
↓
6.Melody 1
↓
18.Melody 13
19.Vibrate
20.Vib → Ring


TOOLS
Set Alarm
Set Time
Calender
Calculator
1.On
2.Off
1.On
2.Off

# SECTION 4: DISASSEMBLY & PARTS

## 4.1 Disassembly Introduction

The T200 is held together by 4 screws. 1 of these screws should be placed under the warranty seal, on the RH side of the phone rear facing towards you, antenna up).
Ensure that a properly grounded high impedance conductive wrist strap is used whilst performing any tasks during the disassembly and assembly of the unit
Avoid stressing the plastics in any way to avoid damage to either the plastics or internal components.

**!! CAUTION !!**

Many of the intergrated devices used in this equipment are vulnerable to damage from electro-static charges. Ensure that adequate static protection is in place when handling, shipping and servicing the internal components of this equipment.

## 4.2 Recommended Tools

The following tools are recommended for use during the assembly / disassembly of the T200.

- Anti-static Mat Kit - 0180386A82, includes:
  *Antistatic mat 66-80387A95*
  *Ground Cord 66-80334B36*
  *Wrist Band 42-80385A59*

- Plastic Bladed Tool SLN7223A
- T6 Torx Driver

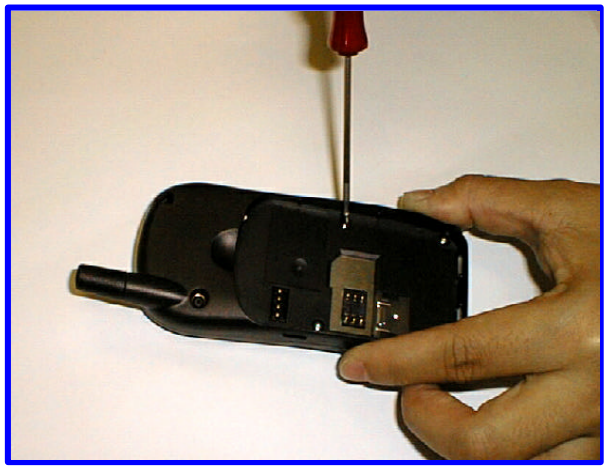
## 4.3 Disassembly Procedure

The following set of diagrams will demonstrate the correct sequence and action required to disassemble the T200
The use of the exploded diagram on pages **19** may be of some assistance for part recognition.

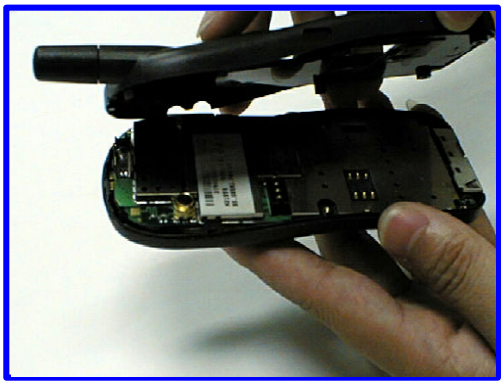
## 4.4 Assembly Procedure

Once the unit is disassembled and the repair is carried out, the unit must then be reassembled, this is carried out in the exact reverse order as the disassembly. Although the housings are put back together parrallel to each other not ‘hinged’ apart as in disassembly.

1. Turn off the telephone.
2. Slide down the battery latch, and remove the battery pack from the housing.



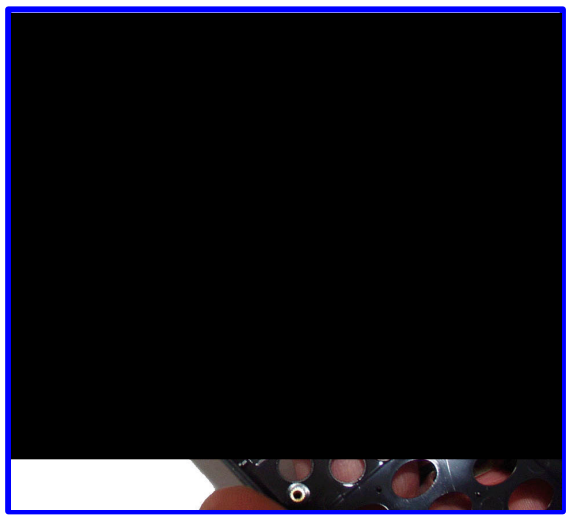
3. Using a T5 Torx driver remove the 4 retaining screws.



4. Unclip the 2 snap fits from the left and right hand sides of the unit and separate the rear from the front housings.

5. Carefully lift the main PCB from the front housing

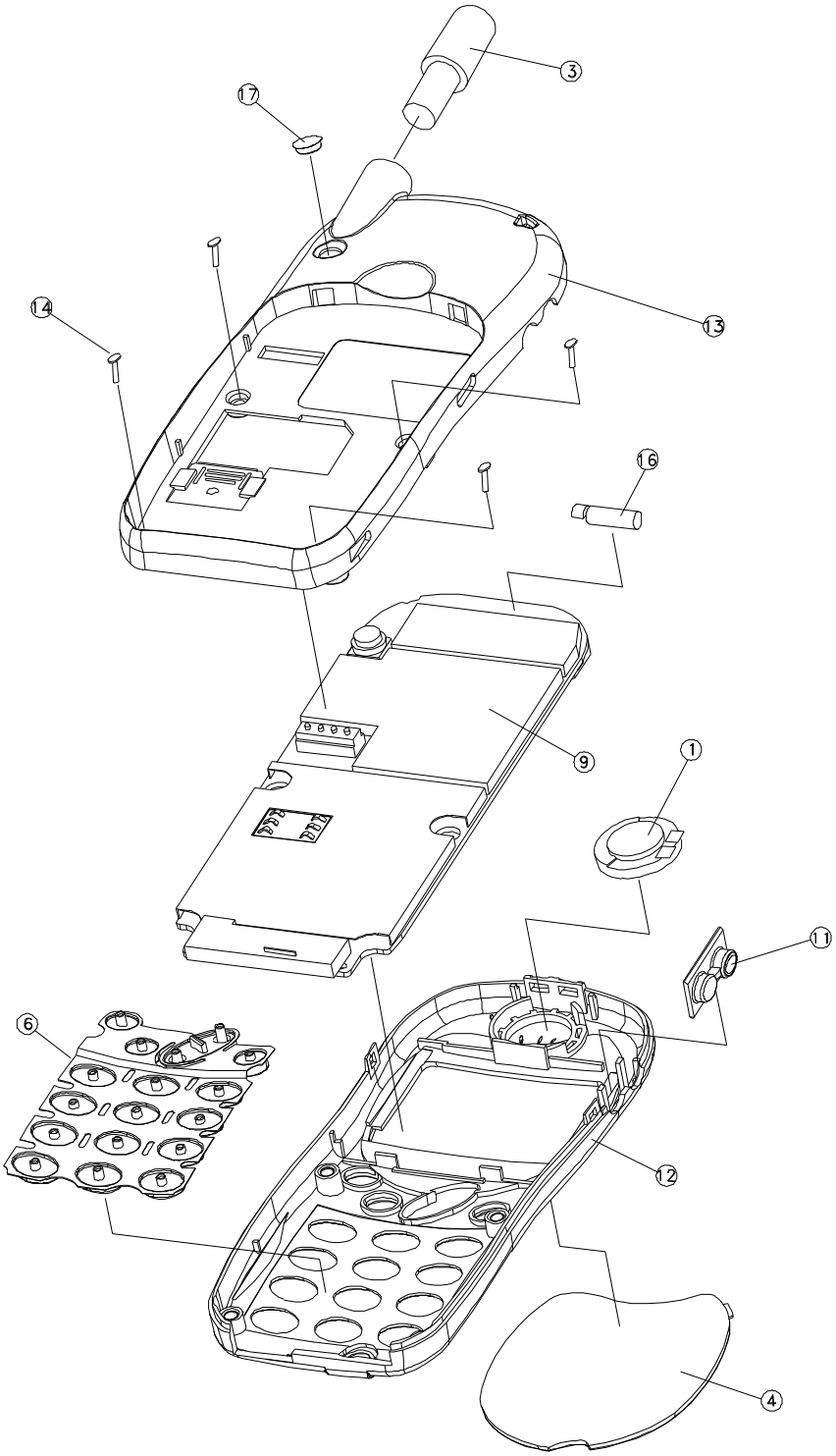
5. Remove Volume buttons by pulling upwards.



6. Insert the pointed end of plastic tool below speaker and pull upwards. Replace with new speaker after removal.

9. Remove keypad from front housing.

## 4.5 Exploded Parts Diagram



## 4.6 Part Numbers

*For Part numbers of other variants please consult Level 1&2 parts list)

| Item | Part number | Description |
|---|---|---|
| 1. | 20.F0075.014 | System connector |
| 2. | 22.10128.006 | SIM card connector |
| 3. | 22.80019.051 | Vibrator motor |
| 4. | 23.40046.001 | Speaker |
| 5. | 23.60016.041 | Buzzer |
| 6. | 23.42007.031 | Microphone |
| 7. | 25.90012.001 | Antenna |
| 8. | 34.G0110.001 | Holder vibrator |
| 9. | 34.G0510.002 | Dome switches |
| 10. | 42.G0102.003 | LCD Holder |
| 11. | 42.G0101.001 | LCD cover |
| 12. | 47.G0101.001 | Keypad |
| 13. | 47.G0101.011 | Keypad (Chinese) |
| 14. | 47.G0104.001 | Microphone holder |
| 15. | 47.G0109.001 | Buzzer cap |
| 16. | 47.G0105.001 | Speaker cushion |
| 17. | 56.07249.071 | LCD module |
| 18. | 60.G0105.001 | Volume-key switch |
| 19. | 60.G0109.003 | Lower case |
| 20. | 60.G0108.003 | Upper case(Blank) |
| 21. | 60.G0108.021 | Upper case(Yellow) |
| 22. | 60.G0108.011 | Upper case(Red) |
| 23. | 60.G0108.041 | Upper case(Blue) |
| 24. | 60.G0108.051 | Upper case(Silver) |
| 25. | 60.G0108.061 | Upper case(Titanium) |
| 26. | 60.G0108.071 | Upper case(Radar Blue) |
| 27. | 86.1A52P.3R5 | Screw M1.6x6.5L |
| 28. | 55.G0501.006 | Main board (PCB) |
| 29. | 50.25001.021 | RF cable |
| 30. | 90.25030.001 | Downloader + cable |

*** The numbers on this part list to not correspond with the part numbers on the exploded diagram.**

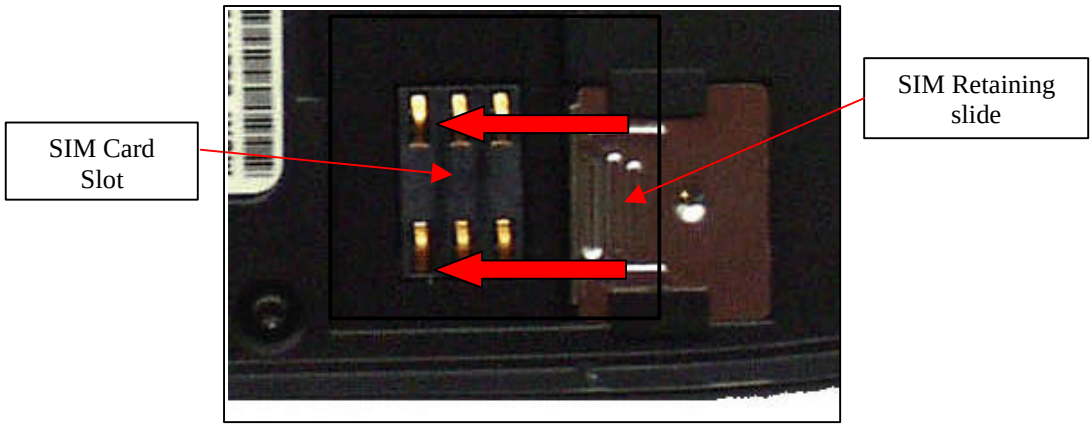
# SECTION 5: SIM CARDS AND SECURITY

## 5.1 Manual Test Mode

The GSM Motorola T200 is equipped with a manual test mode capability. This capability allows service personnel to take control of the unit, and by entering certain keypad commands, make the unit performs desired functions.

To enter the manual test command mode, a GSM / DCS test sim (Part No 8102430Z04) must be used. The test sim is inserted into the SIM slot beneath the battery (See **figure 6.1**), the battery should then be re-inserted and the unit powered on. The # button should then be pressed for approximatly 3 second until 'test' appears on the display, and the correct commands must then be followed.

**Figure 6.1 SIM Card insertion**




## 5.2 Live Sim Card

A SIM (Subscriber Identity module) card will be required to access the existing local GSM / DCS / PCS cellular network, or remote networks when travelling. (If the roaming agreement has been made with the provider.)
The SIM card contains all the data necessary to access GSM services, and also:

- The ability to store user information such as phone numbers etc…
- All information required by the network provider to provide use to the network
- **For WAP Capability the SIM card must be Data enabled**

## 5.4 GSM Test Commands

**This is a list of Level 1 and 2 Manaul Test commands available to the T2688 / T200**

---

1)*#300# OK List the Software and Hard ware version

2)*#301# OK Full Keypads functional Test

3)*#307# OK Engineering Test Mode

4)*#402# OK Adjust Display Intensity/ Contrast

5)*#403# OK List the Manufacturing Informations

6)1998 0722OKMaster Unlock code for Phone and Sim Lock

7)*#302# OK Acoustic test*

1. Greeting
2. Main VlmGain
3. Input Cal
4. Output Cal
5. Side In Gain
6. Vox Gain
7. Min Mic Engy
8. More
   (a) In vlm Gain
   (b) Aux Vlm Gain
   (c) Silence Prd
   (d) Supp Prd
   (e) In Volume
   (f) Out Volume
   (g) Icon
   (h) Image
   (i) Animation

8)#303# OK Settings Saved*

9)#400# OK ADC, Cal val*

- **Use with care - Contains Calibration factors**
- **Please see DM Tools section for other test features.**

## 5.5 Identity and Security

Each Motorola GSM Cellular Cassette will be labelled with various number configurations. The following information describes what these configurations mean.

**MSN**
The mechanical Serial Number (MSN) is an individual unit identity number and will remain with the unit throughout the life of the unit.
The MSN can be used to log and track a unit on Motorola's EPPRS system.
The MSN is divided into 4 sections.

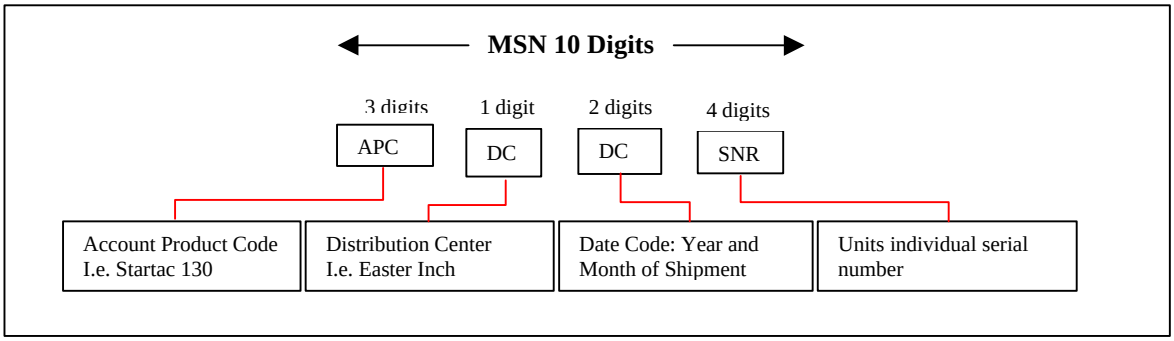



**Figure 5.2 MSN label breakdown**

**IMEI**
The International Mobile station Equipment Identity (IMEI) number is an individual number unique to the PCB and is stored within the unit's memory. The following figure gives a description of the make up of this number.

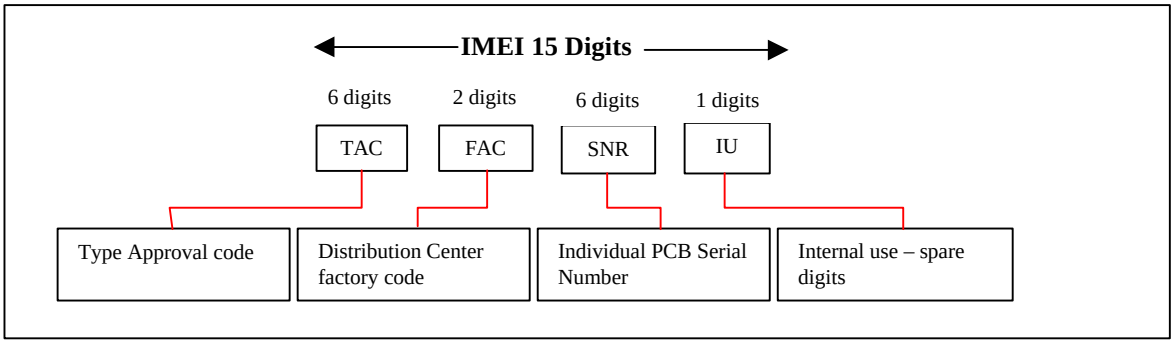



**Figure 5.3 IMEI label breakdown**

Some other label number configurations that will be present will be: -

**XCVR NUMBER:** Identifies type of product. i.e. T200 (Usually SWF / SUG number)

**PACKAGE / MODEL NUMBER:** Determines type of equipment, mode in which it was shipped and language with which it was shipped. e.g SA1255XXXXX

# SECTION 6: REPAIR AND TEST PROCEDURES

## 6.1 Repair Introduction

The T200 is divided into 2 main sections when it comes to part replacability: The housings which contains the speaker, keypad and the Volume Buttons , the main PCB which contains RF / Logic circuitry and the keypad interface and the display. If the RF / Logic board is required to be changed then a full service tranceiver should be ordered as there is no replacement PCB available.

## 6.2 Mechanical repairs

Assembly replacement level troubleshooting and repair of the T200 is limited to isolation and replacement of the main mechanical parts only (See Exploded parts diagram and associated parts list **p19**)

## 6.3 Basic Modular Troubleshooting

The troubleshooting information in **Table 2** shows some typical malfunction symptoms, and for the corresponding verification and repair procedures refer to the disassembly instructions located in the disassembly section of this manual. **(Section 4).**

**NOTE**

**Defective Logic/RF assemblies must be replaced with pre-tested, pre-phased assemblies**

## Repair Chart

**Table 2.** GSM T200 Cellular Telephone: Troubleshooting and Repair Chart. (Assembly Replacement Level).

| SYMPTOM | PROBABLE CAUSE | VERIFICATION AND REMEDY |
|---|---|---|
| Personal telephone will not turn on or stay on | a) Battery pack either discharged or defective | Measure battery. If the battery voltage is <3.6V dc, recharge the battery using the appropriate battery charger. If the battery will not recharge, replace the battery.<br>If battery is not at fault, proceed to b. |
| | b) Battery connectors open or misaligned. | Visually inspect the 4 battery connectors on both the battery assembly and the portable telephone.<br>If necessary, replace the battery. If battery is not at fault, proceed to c |
| | c) Logic/RF Board Assembly Defective. | Remove the Logic/RF Assembly. Substitute a known good assembly and temporarily reassemble the unit. Depress the **PWR** button; if unit turns on and stays on, disconnect the dc power source replace the faulty unit.(see personality transfer). |
| **2.** Personal telephone exhibits poor reception and/or erratic operation (such as calls frequently dropping, Weak and/or distorted audio, etc.). | a) Antenna is defective | Check to make sure that the antenna pin is properly connected into the Logic/ RF assembly. If OK, substitute a known good antenna and test in a call. If the fault is still present, proceed to b. |
| | b) Logic/RF Board Assembly Defective. | Replace Logic/RF Assembly (refer to symptom 1c). Verify that fault has been cleared and replace faulty unit. |
| **3.** Display is erratic, or provides Partial or no display. | a) Logic/RF Board Assembly Defective. | Replace Logic/RF Assembly (refer to symptom 1c). Verify that fault has been cleared and replace faulty unit. |
| **4.** Incoming call alert transducer audio distorted or volume is too low. | a) Logic/RF Board Assembly Defective. | Replace Logic/RF Assembly (refer to symptom 1c). Verify that fault has been cleared and replace faulty unit. |
| **5.** Personal telephone transmit audio is weak, (usually indicated by called parties complaining of difficulty in hearing voice from personal phone). | a) Logic/RF Board Assembly Defective. | Replace Logic/RF Assembly (refer to symptom 1c). Verify that fault has been cleared and replace faulty unit. |
| **6.** Personal telephone receive audio is weak and/or distorted. (From speaker) | a) Connections to/from speaker and Logic/RF Circuit board defective. | Gain access to Logic/RF board as described in the DISASSEMBLY instructions in this manual. Check contact springs on the Logic/RF circuit board. Clean pads if necessary. If spring is at fault proceed to d. If connection is not at fault, Proceed to b. |
| | b) Earpiece Speaker defective. | Remove speaker from front housing and insert known good speaker. Place a call and verify improvement in earpiece audio. If better, reassemble the phone with the good speaker. If it was no better then proceed to c. |
| | c) Antenna assembly is defective. | Check to make sure that the antenna pin is properly connected into the Logic/ RF assembly. If OK, substitute a known good antenna and test in a call. If the fault is still present, proceed to d. |
| | d) Logic/RF Board Assembly Defective. | Replace Logic/RF Assembly (refer to symptom 1c). Verify that fault has been cleared and replace faulty unit. |

| SYMPTOM | PROBABLE CAUSE | VERIFICATION AND REMEDY |
|---|---|---|
| **7.** Personal telephone will not recognize/accept SIM card | a) SIM card defective | Initially check that the contacts on the card are not dirty and that the SIM retention latch is pushed fully across. Clean if necessary, and check if fault has been eliminated. If the contacts are clean, insert a Known good SIM card into the portable telephone. Power up the unit and confirm whether or not the card has been accepted. If the fault no longer Exists, the defective SIM card should be replaced. If the SIM card is not at fault, proceed to b. |
| | b) SIM retention latch defective | Remove rear housing as per DISASSEMBLY instructions and replace with known good rear housing, ensure the latch is pushed fully across, if unit now tests OK, replace faulty rear housing. If not proceed to c) |
| | c) Logic/RF Board Assembly Defective. | Replace Logic/RF Assembly (refer to symptom 1c). Verify that fault has been cleared and replace faulty unit. |
| **9.** Internal Charger not working | a) Faulty Charger | Attempt to charge unit with known good charger, if OK replace charger. If fault still exists, proceed to b) |
| | b) Logic/RF Board Assembly Defective. | Replace Logic/RF Assembly (refer to symptom 1c). Verify that fault has been cleared and replace faulty unit. |
| **10.** Weak or No vibrate Function | a) Defective Vibrate motor | Access Vibrate motor using DISASSEMBLY procedure, unplug and replace vibrator with known good assembly. If unit now vibrates OK, build unit back up with good vibrator. If fault still exists proceed to b) |
| | b) Logic/RF Board Assembly Defective. | Replace Logic/RF Assembly (refer to symptom 1c). Verify that fault has been cleared and replace faulty unit. |

## 6.4 Software Upgrade

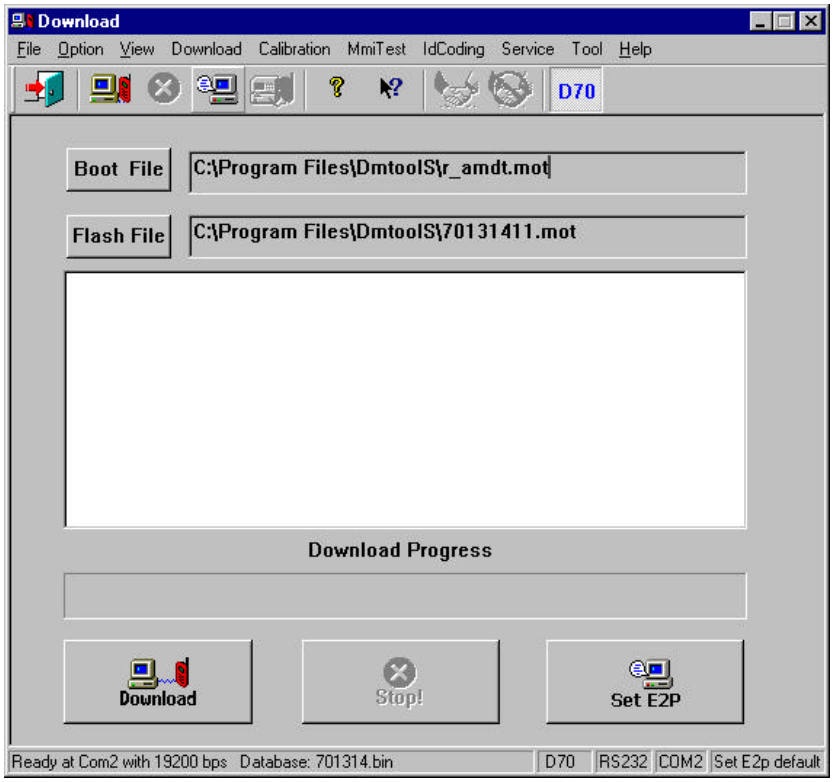
See DM Tool section

## 6.5 Flexing

See DM Tools section

## 6.6 Testing on DM TOOLS

Below is the power up screen on selecting DM Tools.




**File Types:**

Boot file is of type .mot and the naming protocol is of the form r_amdt.mot
Flash file is of type .mot and the naming protocol is taken from the s/w version
As seen above 70131411.mot
**Database file is a binary (.bin)type and the naming protocol is also derived from The s/ware version e.g. 701314.bin**

First select ***options*** from tool bar then:

Set comm port either 1 or 2 (the gray dot indicates selected port).
Set baud rate 19200 to allow flexing access.
Set eeprom mode default.
Remove charger jack from download box.

**Note**:
To upgrade the s/w from 701205 to 701214 you must use the database file, associated with the older version (701205). So in the ***Choose Database File*** you would choose 701205.bin instead of 701214.bin

To then use flexing tools, the database should be changed to the later version, in this case 701214.bin

The software for the T205 is 7013xx and for the T200 it is 7012xx

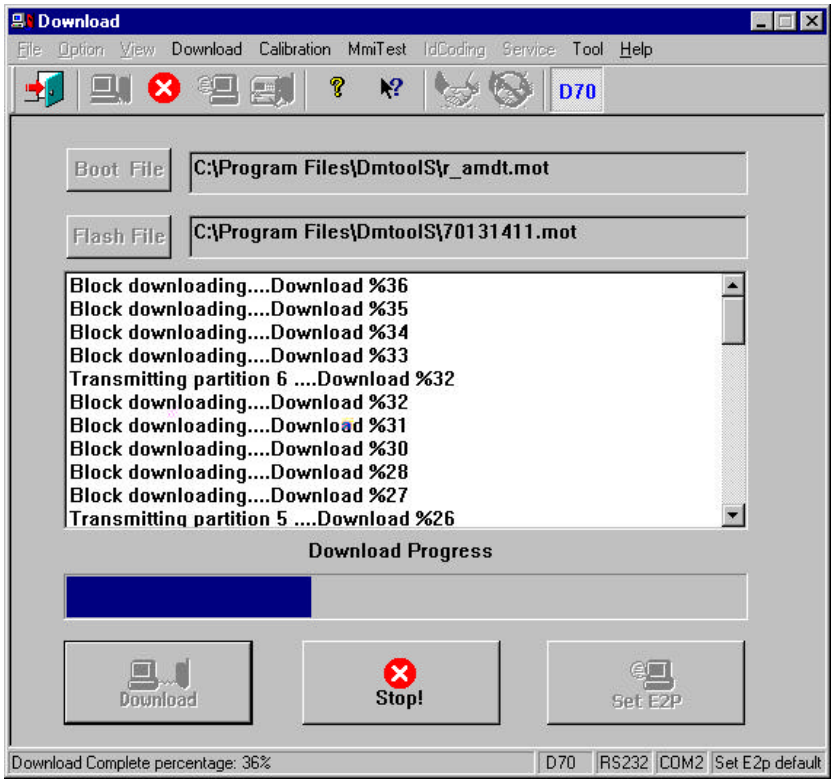
The selection of the Boot file is as above
The Flash file is derived from the s/w version as above

The database file is a filename.bin configuration, and again is derived from the s/w version. (In this case 701314.bin)
Selecting the ***Files*** option on the tool bar may change all the files.

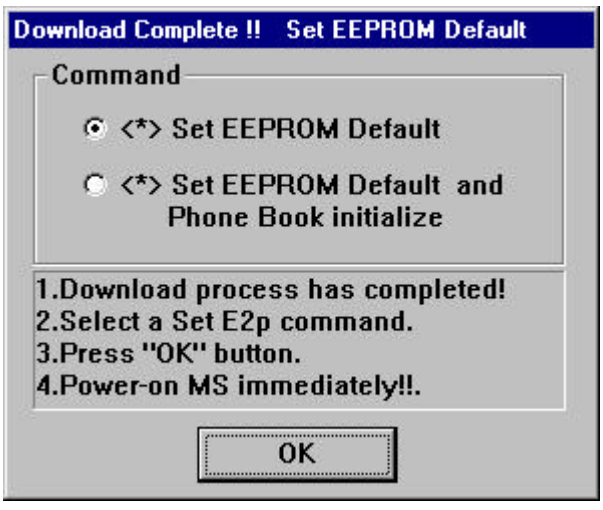
**Flashing Procedure STEP 1**
After selecting the correct files, plug phone into cable but **DO NOT** power on. Then hit the download button.

When you get to this point you have 10 seconds to power the phone on
If you don't power the phone on in the 10 seconds then DM Tools will see this as a flash fail.
Assuming no problems the following screen should be seen during the flashing procedure

Screen dump during flash



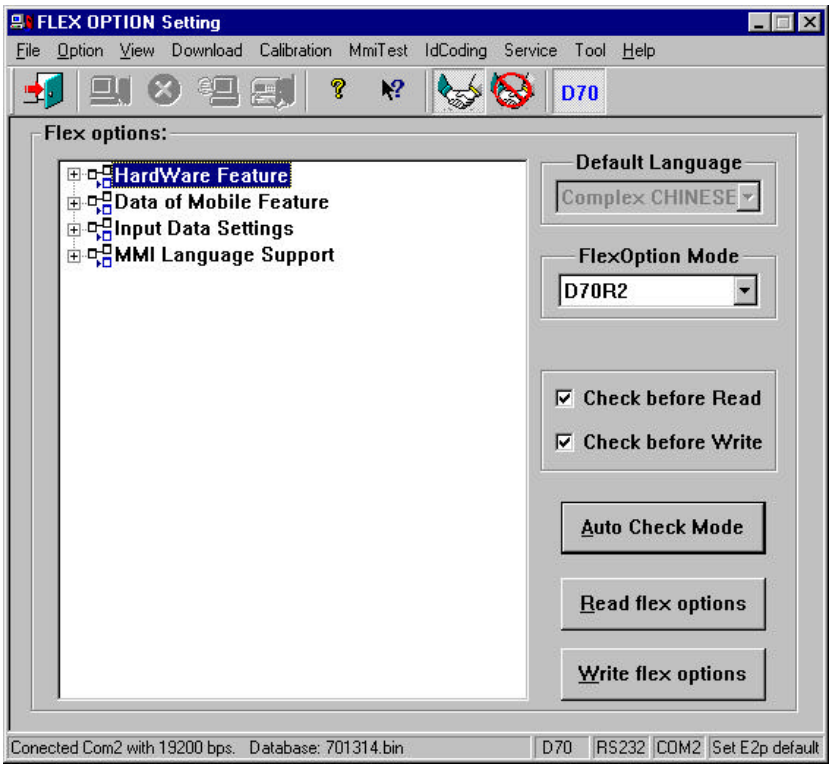

The flashing procedure also flexes the phone. At the end of the download the following screen can be seen.



Follow instruction's above to flex phone.

**Flexing Procedure**

Select ***Service*** from tool bar and choose the ***Flex*** option to obtain the following screen.

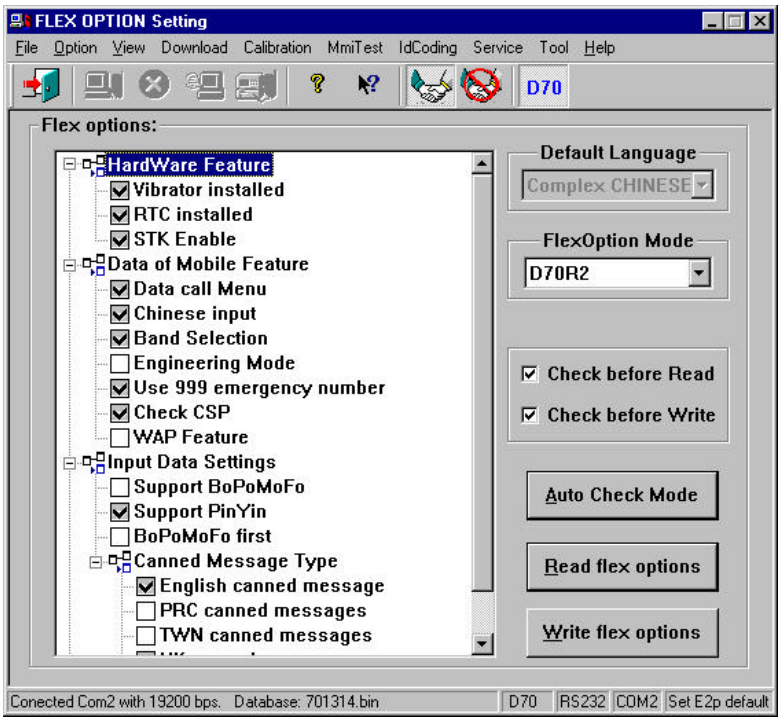



The flex settings are loaded from a file with designation (.fle ) and is known as FlexOption Profile. The load option is obtained by right clicking the mouse on the DM Tools's window, and then selecting ***Load from Profile***.

The U.U.T. should be powered on first for all flexing operations

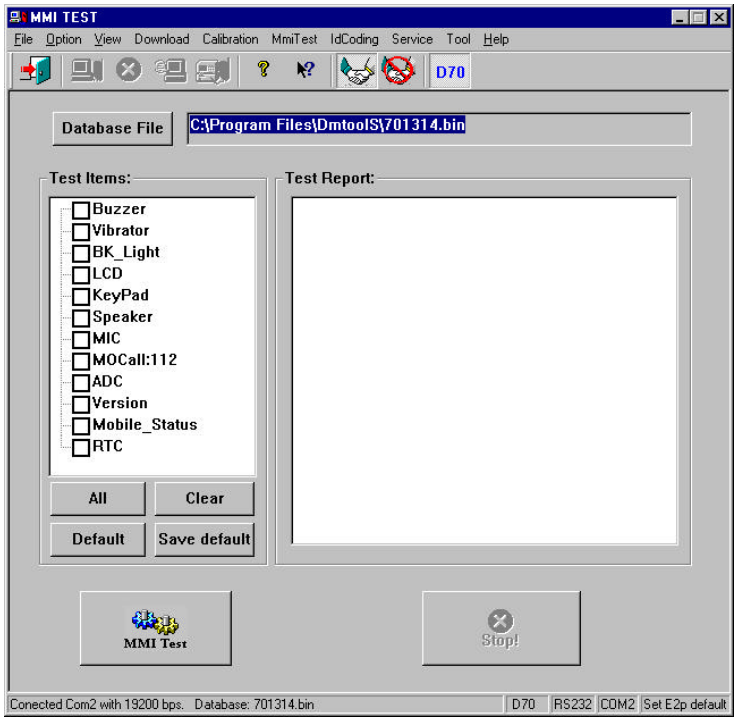
**Flexing options screen**.

***The flex options are password protected and can not be changed manually unless the key and password are known.**




**TEST COMMANDS**

Select ***View*** from tool bar and highlight ***MMI Test*** to obtain the following screen.
Then tick the appropriate test and press the ***MMI Test*** button and follow instructions.



# SECTION 7: ACCESSORIES

**7.1 Introduction:** The following is a short description of accessories available for the T200 that are currently available.

Switch mode Travel Charger

- Input: 90-260V, varies by plug type for each country, AC
- Output: 6V, 750 mA

Linear Travel Charger

- Input: voltage and plug requirements per each country, AC

Cigarette Charger

- Input: 12-24V, DC
- Output: 6V, 750 mA

Portable Hands-free
(plugs into butt plug)

Desktop charger base – conceptual design.

**Picture not available**

Simple car kit.

**Picture not available**

Data Cable

Switch mode and linear travel chargers with these plug types are required: US (without holes in prongs for the PRC), UK, Euro, Aust/NZ, India.

# SECTION 8: SALES MODEL NUMBERS

## 8.1 Sales Model Numbers

**Part Number of T200 with T-options**

| Country | T-option | API p/n | Color | Moto p/n | Descripton |
|---|---|---|---|---|---|
| Australia | T948UB | 99.G0521.BOF | Copper Orange | SA2143AE5B1 | SA2143AE5B1,AU ORG |
| *Telstra* | T948UB | 99.G0521.BGF | Misty Green | SA2143AF5B1 | SA2143AF5B1,AU GRN |
| | T948UB | 99.G0521.BIF | Teal Ice | SA2143AG5B1 | SA2143AG5B1,AU ICE |
| | T948UB | 99.G0521.BBF | Elec Blue | SA2143AJ3B1 | SA2143AJ3B1,AU EBU |
| Australia | T948UC | 99.G0521.COF | Copper Orange | SA2143AE5B1 | SA2143AE5B1,AU ORG |
| *Optus* | T949UC | 99.G0521.CGF | Misty Green | SA2143AF5B1 | SA2143AF5B1,AU GRN |
| | T950UC | 99.G0521.CIF | Teal Ice | SA2143AG5B1 | SA2143AG5B1,AU ICE |
| | T951UC | 99.G0521.CBF | Elec Blue | SA2143AJ3B1 | SA2143AJ3B1,AU EBU |
| Australia | T948UD | 99.G0521.DOF | Copper Orange | SA2143AE5B1 | SA2143AE5B1,AU ORG |
| *Vodafone* | T948UD | 99.G0521.DGF | Misty Green | SA2143AF5B1 | SA2143AF5B1,AU GRN |
| | T948UD | 99.G0521.DIF | Teal Ice | SA2143AG5B1 | SA2143AG5B1,AU ICE |
| | T948UD | 99.G0521.DBF | Elec Blue | SA2143AJ3B1 | SA2143AJ3B1,AU EBU |
| Australia | T948UE | 99.G0521.EOF | Copper Orange | SA2143AE5B1 | SA2143AE5B1,AU ORG |
| *OneTel* | T948UE | 99.G0521.EGF | Misty Green | SA2143AF5B1 | SA2143AF5B1,AU GRN |
| | T948UE | 99.G0521.EIF | Teal Ice | SA2143AG5B1 | SA2143AG5B1,AU ICE |
| | T948UE | 99.G0521.EBF | Elec Blue | SA2143AJ3B1 | SA2143AJ3B1,AU EBU |
| Australia | T948UF | 99.G0521.FOF | Copper Orange | SA2143AE5B1 | SA2143AE5B1,AU ORG |
| *Distributors* | T948UF | 99.G0521.FGF | Misty Green | SA2143AF5B1 | SA2143AF5B1,AU GRN |
| | T948UF | 99.G0521.FIF | Teal Ice | SA2143AG5B1 | SA2143AG5B1,AU ICE |
| | T948UF | 99.G0521.FBF | Elec Blue | SA2143AJ3B1 | SA2143AJ3B1,AU EBU |

| | | | | | |
|---|---|---|---|---|---|
| NZ | T948UG | 99.G0521.GOD | Copper Orange | SA2147AE5B1 | SA2147AE5B1,NZ ORG |
| | T948UG | 99.G0521.GGD | Misty Green | SA2147AF5B1 | SA2147AF5B1,NZ GRN |
| | T948UG | 99.G0521.GID | Teal Ice | SA2147AG5B1 | SA2147AG5B1,NZ ICE |
| | T948UG | 99.G0521.GBD | Elec Blue | SA2147AJ3B1 | SA2147AJ3B1,NZ EBU |
| NZ | T948UH | 99.G0521.HOD | Copper Orange | SA2147AE5B1 | SA2147AE5B1,NZ ORG |
| | T948UH | 99.G0521.HGD | Misty Green | SA2147AF5B1 | SA2147AF5B1,NZ GRN |
| | T948UH | 99.G0521.HID | Teal Ice | SA2147AG5B1 | SA2147AG5B1,NZ ICE |
| | T948UH | 99.G0521.HBD | Elec Blue | SA2147AJ3B1 | SA2147AJ3B1,NZ EBU |

| | | | | | |
|---|---|---|---|---|---|
| Maly/SGP | T948UP | 99.G0521.POH | Copper Orange | SA2150AE5B1 | SA2150AE5B1,SG ORG |
| | T948UP | 99.G0521.PGH | Misty Green | SA2150AF5B1 | SA2150AF5B1,SG GRN |
| | T948UP | 99.G0521.PIH | Teal Ice | SA2150AG5B1 | SA2150AG5B1,SG ICE |
| | T948UP | 99.G0521.PBH | Elec Blue | SA2150AJ3B1 | SA2150AJ3B1,SG EBU |
| Maly/SGP | T948UQ | 99.G0521.QOH | Copper Orange | SA2150AE5B1 | SA2150AE5B1,SG ORG |
| | T948UQ | 99.G0521.QGH | Misty Green | SA2150AF5B1 | SA2150AF5B1,SG GRN |
| | T948UQ | 99.G0521.QIH | Teal Ice | SA2150AG5B1 | SA2150AG5B1,SG ICE |
| | T948UQ | 99.G0521.QBH | Elec Blue | SA2150AJ3B1 | SA2150AJ3B1,SG EBU |
| Maly/SGP | T948UR | 99.G0521.ROH | Copper Orange | SA2150AE5B1 | SA2150AE5B1,SG ORG |
| | T948UR | 99.G0521.RGH | Misty Green | SA2150AF5B1 | SA2150AF5B1,SG GRN |
| | T948UR | 99.G0521.RIH | Teal Ice | SA2150AG5B1 | SA2150AG5B1,SG ICE |
| | T948UR | 99.G0521.RBH | Elec Blue | SA2150AJ3B1 | SA2150AJ3B1,SG EBU |
| Maly/SGP | T948US | 99.G0521.SOH | Copper Orange | SA2150AE5B1 | SA2150AE5B1,SG ORG |
| | T948US | 99.G0521.SGH | Misty Green | SA2150AF5B1 | SA2150AF5B1,SG GRN |
| | T948US | 99.G0521.SIH | Teal Ice | SA2150AG5B1 | SA2150AG5B1,SG ICE |
| | T948US | 99.G0521.SBH | Elec Blue | SA2150AJ3B1 | SA2150AJ3B1,SG EBU |
| Maly/SGP | T948UW | 99.G0521.WOH | Copper Orange | SA2150AE5B1 | SA2150AE5B1,SG ORG |
| | T948UW | 99.G0521.WGH | Misty Green | SA2150AF5B1 | SA2150AF5B1,SG GRN |
| | T948UW | 99.G0521.WIH | Teal Ice | SA2150AG5B1 | SA2150AG5B1,SG ICE |
| | T948UW | 99.G0521.WBH | Elec Blue | SA2150AJ3B1 | SA2150AJ3B1,SG EBU |
| Maly/SGP | T948UX | 99.G0521.XOH | Copper Orange | SA2150AE5B1 | SA2150AE5B1,SG ORG |
| | T948UX | 99.G0521.XGH | Misty Green | SA2150AF5B1 | SA2150AF5B1,SG GRN |
| | T948UX | 99.G0521.XIH | Teal Ice | SA2150AG5B1 | SA2150AG5B1,SG ICE |
| | T948UX | 99.G0521.XBH | Elec Blue | SA2150AJ3B1 | SA2150AJ3B1,SG EBU |
| Maly/SGP | T948UY | 99.G0521.YOH | Copper Orange | SA2150AE5B1 | SA2150AE5B1,SG ORG |
| | T948UY | 99.G0521.YGH | Misty Green | SA2150AF5B1 | SA2150AF5B1,SG GRN |
| | T948UY | 99.G0521.YIH | Teal Ice | SA2150AG5B1 | SA2150AG5B1,SG ICE |
| | T948UY | 99.G0521.YBH | Elec Blue | SA2150AJ3B1 | SA2150AJ3B1,SG EBU |
| Maly/SGP | T948UZ | 99.G0521.ZOH | Copper Orange | SA2150AE5B1 | SA2150AE5B1,SG ORG |
| | T948UZ | 99.G0521.ZGH | Misty Green | SA2150AF5B1 | SA2150AF5B1,SG GRN |
| | T948UZ | 99.G0521.ZIH | Teal Ice | SA2150AG5B1 | SA2150AG5B1,SG ICE |
| | T948UZ | 99.G0521.ZBH | Elec Blue | SA2150AJ3B1 | SA2150AJ3B1,SG EBU |

**Part Number of T200 with SIM Lock**

| Country | T-option | API p/n | Color | Moto p/n | Descripton |
|---|---|---|---|---|---|
| Thailand | AIS/DPC | 99.G0521.AOB | Copper Orange | SA2145AE5X3 | SA2145AE5X3,THA ORG |
| | AIS/DPC | 99.G0521.AGB | Misty Green | SA2145AF5X3 | SA2145AF5X3,THA GRN |
| | AIS/DPC | 99.G0521.AIB | Teal Ice | SA2145AG5X3 | SA2145AG5X3,THA ICE |
| | AIS/DPC | 99.G0521.ABB | Elec Blue | SA2145AJ3X3 | SA2145AJ3X3,THA EBU |
| Thailand | TAC | 99.G0521.BOB | Copper Orange | SA2151AE5X3 | SA2151AE5X3,THA ORG |
| | TAC | 99.G0521.BGB | Misty Green | SA2151AF5X3 | SA2151AF5X3,THA GRN |
| | TAC | 99.G0521.BIB | Teal Ice | SA2151AG5X3 | SA2151AG5X3,THA ICE |
| | TAC | 99.G0521.BBB | Elec Blue | SA2151AJ3X3 | SA2151AJ3X3,THA EBU |
| Philippines | T948UJ | 99.G0521.JOC | Copper Orange | SA2148AE5B1 | SA2148AE5B1,PHI ORG |
| | T948UJ | 99.G0521.JGC | Misty Green | SA2148AF5B1 | SA2148AF5B1,PHI GRN |
| | T948UJ | 99.G0521.JIC | Teal Ice | SA2148AG5B1 | SA2148AG5B1,PHI ICE |
| | T948UJ | 99.G0521.JBC | Elec Blue | SA2148AJ3B1 | SA2148AJ3B1,PHI EBU |
| Philippines | T948UK | 99.G0521.KOC | Copper Orange | SA2148AE5B1 | SA2148AE5B1,PHI ORG |
| | T948UK | 99.G0521.KGC | Misty Green | SA2148AF5B1 | SA2148AF5B1,PHI GRN |
| | T948UK | 99.G0521.KIC | Teal Ice | SA2148AG5B1 | SA2148AG5B1,PHI ICE |
| | T948UK | 99.G0521.KBC | Elec Blue | SA2148AJ3B1 | SA2148AJ3B1,PHI EBU |
| Philippines | T948UL | 99.G0521.LOC | Copper Orange | SA2148AE5B1 | SA2148AE5B1,PHI ORG |
| | T948UL | 99.G0521.LGC | Misty Green | SA2148AF5B1 | SA2148AF5B1,PHI GRN |
| | T948UL | 99.G0521.LIC | Teal Ice | SA2148AG5B1 | SA2148AG5B1,PHI ICE |
| | T948UL | 99.G0521.LBC | Elec Blue | SA2148AJ3B1 | SA2148AJ3B1,PHI EBU |
| Philippines | T948UM | 99.G0521.MOC | Copper Orange | SA2148AE5B1 | SA2148AE5B1,PHI ORG |
| | T948UM | 99.G0521.MGC | Misty Green | SA2148AF5B1 | SA2148AF5B1,PHI GRN |
| | T948UM | 99.G0521.MIC | Teal Ice | SA2148AG5B1 | SA2148AG5B1,PHI ICE |
| | T948UM | 99.G0521.MBC | Elec Blue | SA2148AJ3B1 | SA2148AJ3B1,PHI EBU |
| Philippines | T948UN | 99.G0521.NOC | Copper Orange | SA2148AE5B1 | SA2148AE5B1,PHI ORG |
| | T948UN | 99.G0521.NGC | Misty Green | SA2148AF5B1 | SA2148AF5B1,PHI GRN |
| | T948UN | 99.G0521.NIC | Teal Ice | SA2148AG5B1 | SA2148AG5B1,PHI ICE |
| | T948UN | 99.G0521.NBC | Elec Blue | SA2148AJ3B1 | SA2148AJ3B1,PHI EBU |
| Philippines | T948VD | 99.G0521.VOC | Copper Orange | SA2148AE5B1 | SA2148AE5B1,PHI ORG |
| | T948VD | 99.G0521.VGC | Misty Green | SA2148AF5B1 | SA2148AF5B1,PHI GRN |
| | T948VD | 99.G0521.VIC | Teal Ice | SA2148AG5B1 | SA2148AG5B1,PHI ICE |
| | T948VD | 99.G0521.VBC | Elec Blue | SA2148AJ3B1 | SA2148AJ3B1,PHI EBU |

# SECTION 9: GLOSSARY OF TERMS

## 9.1 List of Abbreviations

Those marked ** are Motorola specific abbreviations.

| | |
|---|---|
| µBGA | Micro Ball Grid Array |
| A Interface | Interface between MSC and BSS |
| A3 | Authentication algorithm |
| A5 | Stream cipher algorithm |
| A8 | ciphering key generating algorithm |
| AB | Access Burst |
| A-bis | Interface between BSC and BTS |
| ACCH | Associated Control Channel |
| ACSE | Association Control Service Element |
| AGCH | Access Grant Channel |
| AMPS | Advance Mobile Phone System |
| AOC | Advice of charge |
| ARFCN | Absolute Radio Frequency Channel Number |
| ARQ | Automatic Request for retransmission |
| ASIC | Application Specific Integrated Circuit |
| AUC | Authentication Center |
| AUT (H) | Authentication |
| BA | BCCH Allocation |
| BAIC | Barring of All Incoming Calls |
| BAOC | barring of all Outgoing Calls |
| BCC | Base Transceiver Station (BTS) Color Code |
| BCCH | Broadcast Control Channel |
| BCD | Binary Coded Decimal |
| BGA | Ball Grid Array |
| BCU | BTS Control Unit ** |
| Bm | Full-rate traffic channel |
| BN | Bit Number |
| BS | Base Station |
| BSC | Base Station Controller |
| BSIC | Base Transceiver Station Identity Code |
| BSS | Base Station System |
| BSSAP | BSS Application Part (DTAP and BSSMAP) |
| BSSC | Base Station System Control Cabinet ** |
| BSSMAP | Base Station Systems Management Application Part |
| BSSOMAP | BSS Operation and Maintenance Application Part |
| BSU | Base Site Controller Unit ** |
| BTS | Base Transceiver Station |
| CA | Call Allocation |
| CBCH | Call Broadcast Channel |
| cc | Call Control |
| cc | Country Code |
| CC | Cellular Cassette |
| CCBS | Completion of Calls to Busy Subscribers |
| CCH | Control Channel |
| CCCH | Common Control Channel |
| CDMA | Code Division Multiple Access |
| CFS | Call Forwarding on mobile Subscriber busy |
| CFU | Call Forwarding Unconditional |
| CLIP | Calling Line Identification Presentation |
| CLIR | Calling Line Identification Restriction |
| CM | Connection Management |

| | |
|---|---|
| COLP | Connected Line identification Presentation |
| COLR | Connected Line identification Restriction |
| CONF | Conference Call add on |
| CSPDN | Circuit Switched Public Data Network |
| CUG | Closed User Group |
| CW | Call Waiting |
| DB | Dummy Burst |
| DBS | Distributed Base Station ** |
| DCCH | Dedicated Control Channel |
| DET | Detach |
| DFE | Decision Feedback Equalizer |
| DISC | Disconnect |
| DL | Data Link (layer) |
| Dm | Control Channel (ISDN terminology applied to mobile service) |
| Dm | Signaling channel |
| Dp | Dialed Pulse |
| DRCU | Diversity Radio Channel Unit** |
| DRX | Discontinuous Reception |
| DTAP | Direct Transfer Application Part |
| DTE | Data Terminal Equipment |
| DTMF | Dual Tone Multi-Frequency (tone signaling type) |
| DTX | Discontinuous Transmission |
| E | erlang |
| Eb/No | Energy per Bit/Noise floor |
| EC | Echo Canceller |
| Ec/No | Ratio of energy per modulating bit to the noise spectral density |
| EGSM | Extended Group special Mobile |
| EFR | Enhanced Full Rate |
| EIR | Equipment Identity Register |
| EIRP | Effective Isotropic Radiated Power |
| EMC | Electromagnetic Compatibility |
| EMX | Electronic Mobile Exchange ** |
| ETSI | European Telecommunications Standards Institute |
| FACCH | Fast Associated Control channel |
| FACCH/F | Full rate Fast Associated Control channel |
| FACCH/H | Half rate fast Associated Control channel |
| FB | Frequency correction burst |
| FCCH | Frequency Correction Channel |
| FEC | Forward Error Correction |
| FN | Frame Number |
| FR | Full Rate |
| FTAM | File Transfer Access Management |
| GCC | Global Call Center |
| GMSC | Gateway Mobile Services Switching Center |
| GMSK | Gaussian Minimum Shift Keying |
| GSM | Group Special Mobile |
| GSM MS | GSM Mobile Station |
| GSM PLMN | GSM Public Land Mobile Network |
| HANDO | Handover |
| HATIS | Hearing Aid Telephone Interconnection System |
| HDLC | High Level Data Link Control |
| HLR | Home Location Register |
| HOLD | Call Hold (Supplementary Service) |

| | |
|---|---|
| HPLMN | Home PLMN |
| HPU | Hand Portable Unit |
| HR | Half Rate |
| HSN | Hopping Sequence Number |
| | |
| I | Information (frames) |
| IA5 | International Alphanumeric 5 |
| ID | Identification |
| IMEI | International Mobile Equipment Identity |
| IMM | Immediate assignment message |
| IMSI | International Mobile Subscriber Identity |
| IN | Intelligent Network |
| INDY | Iridium 9500 handset |
| IrDA | Infra Red Data Association |
| ISC | International Switching Center |
| ISU | Iridium Subscriber Unit |
| ISDN | Integrated Services Digital Network |
| ISUP | ISDN User Part |
| IWF | Interworking Function |
| | |
| Kc | ciphering Key |
| Ki | Individual subscriber authentication key |
| | |
| LAC | Location Area Code |
| LAI | Location Area Identification (Identity) |
| LAPB | Link Access Procedure ‘B’ (balanced) channel |
| LAPDm | Link Access Procedure ‘DM’ (mobile ‘D’) channel |
| Lm | Traffic channel (with capacity lower than Bm) |
| LPC | Linear Predictive Code |
| LR | Location Register |
| | |
| MA | Mobile Allocation |
| MAH | Mobile Access Hunting |
| MAI | Mobile Allocation Index |
| MAIO | Mobile Allocation Index Offset |
| MAP | Mobile Application Part |
| MCC | Mobile Country Code |
| MCI | Malicious Call Identification |
| MD | Mediation Device |
| ME | Mobile Equipment |
| MF | Multi-Frequency (tone signaling type) |
| MLSE | Maximum Likelihood Sequence Estimator |
| MM | Mobility Management |
| MMI | Man Machine Interface |
| MNC | Mobile Network Code |
| MO | Mobile Originated |
| MO/PP | Mobile Originated Point to Point messages |
| MoU | Memorandum of Understanding |
| MRN | Mobile Roaming Number |
| MS | Mobile Station |
| MSC | Mobile Services Switching Center |
| MSCM | Mobile Station Class Mark |
| MSIN | Mobile Station Identification Number |
| MSISDN | Mobile Station international ISDN number |
| MSRN | Mobile Station Roaming Number |
| MT | Mobile Termination |
| MTP | Message Transfer Part |
| MT/PP | Mobile Terminated Point to Point messages |

| | |
|---|---|
| NAMPS | North American-Advance Mobile Phone System |
| NB | Normal Burst |
| NE | Network Elements |
| NET | Norme European de Telecommunications |
| NM | Network Management |
| NHC | Network Management Center |
| O&M | Operations and Maintenance |
| OACSU | Off Air Call Set-Up |
| OCB | Outgoing Calls Barred |
| OMAP | Operations and Maintenance Application Part (previously was OAMP) |
| OMC | Operations and Maintenance Center |
| OMCR | Operations and Maintenance Center -Radio Part |
| OMCS | Operations and Maintenance Center -Switch Part |
| OSI | Open System Interconnection |
| PAD | Packet Assembly Disassembly facility |
| PCH | Paging Channel |
| PDN | Public Data Networks |
| PIN | Personal Identification Number |
| PLMN | Public Land Mobile Network |
| POTS | Plain Old Telephone Service (basic telephone services) |
| PSPDN | Public Switched Packet Data Network |
| PSTN | Public Switched Telephone |
| PTO | Public Telecommunications Operator |
| QOS | Quality of Service |
| RAB | Random Access Burst |
| RACH | Random Access Channel |
| RBDS | Remote BSS Diagnostic Subsystem ** |
| RBU | Remote Base Station Unit (PCN) ** |
| RCU | Radio Channel Unit ** |
| REC | Recommendation |
| REL | Release |
| RELP-LTP | Regular Pulse Excitation - Long Term Prediction |
| REQ | Request |
| RFCH | Radio Frequency Channel |
| RFN | Reduced TDMA Frame Number |
| RLP | Radio Link Protocol |
| ROSE | Remote Operations Service Element (a CCITT specification for O&M) |
| RXCDR | Remote Transcoder Unit ** |
| RXLEV | Received signal level |
| RXQUAL | Received signal quality |
| SABM | Set Asynchronous Balance Model |
| SACCH | Slow Associated Control Channel |
| SAPI | Service Access Point Indicator (Identifier) |
| SB | Synchronization Burst |
| SC | Service Center |
| SCCP | Signaling Connection Control Part |
| SCH | Synchronization Channel |
| SCP | Service Control Point - an intelligent network entity |
| SDCCH | Stand-alone Dedicated Control Channel |
| SDL | Specification Description Language |
| SFH | Slow Frequency Hopping |
| SIM | Subscriber Identity Module |
| SMS | Short Message Service |

| | |
|---|---|
| SMSCB | Short Message Service Call Broadcast |
| SND | SeND |
| SP | Signaling Point |
| SRES | Signed RESponse (authentication) |
| SS | Supplementary Service |
| SS | System Simulator |
| STP | Signaling Transfer Point |
| SYSGEN | SYStem GENeration |
| TA | Terminal Adapter |
| TA | Timing Advance |
| TCAP | Transaction Capabilities Application Part |
| TCH | Traffic Channel |
| TCH/F | A full rate TCH |
| TCH/FS | A full rate speech TCH |
| TCH/HS | A half rate speech TCH |
| TCP | Transmission Control Protocol |
| TDMA | Time Division Multiple Access |
| TE | Terminal Equipment |
| TMN | Telecommunications Management Network |
| TMSI | Temporary Mobile Subscriber Identity |
| TN | Timeslot Number |
| TRX | Transceivers |
| TTY | TeleTYpe (refers to any terminal) |
| TS | Time Slot |
| TUP | Telephone Users Part |
| UI | Unnumbered Information frame |
| Um | Air Interface |
| USSD | Unstructured Supplementary Services Data |
| VAD | Voice Activity Detection |
| VLR | Visited Location Register |
| VLSI | Very Large Scale Integration (IC) |
| VPLMN | Visited PLMN |
| XC | Transcoder |
| XCDR | Transcoder ** |
| 3PTY | Three party service |

MOTOROLA
Personal Communications Sector

GSM Service Support
Level 3 Authorized

# T2688/T200
# T2988/T205

GSM Service Support
Training - Documentation - Engineering

# Level 3
# Circuit Description
# 01 / 03 / 01
# V1.3



Motorola Proprietary Information

## RECEIVE

1. Received GSM 900 frequency enters the unit at the Antenna ANT1
2. L501 / L502 / L503 provide matching
3. The signal then enters mechanical Auxiliary RF port U113. When a load (50? is placed into the socket the RF will be diverted into or out of U113). This socket will be used for phasing, testing purposes.
4. From U113 **Pin 1** to RF Switch U501 **Pin 9** (**ANT**), where through control voltages the Rx path is isolated from the TX path. The following voltages control the RF Switch: **VC1 – VC4**, which are all 0V or 3.6V Low or High respectively.
   The controlling input signals are:
   - **BS** (Band Select), this signal determines GSM (Logic 0) or DCS (Logic 1) – 2.8V (originates as **BANDSW** from Gemini **Pin 65**)
   - **PA_ON**, this signal determines if the TX burst is on progress (for use with the RF Switch only) – 2.8V (originates as **TXPA** from Gemini **Pin 119**)
   - **VBAT**, is the battery voltage and supports both U502 which is the Logic control for the RF switch and the inverter IC501 - 3.3V – 3.6V

   Below are the states of **VC1 – VC4** and the relative states of **BS** and **PA_ON** for each of the 4 scenarios.

| | VC1 | VC2 | VC3 | VC4 | BS | PA_ON |
|---|---|---|---|---|---|---|
| GSM RX | 0V | 3.6V | 3.6V | 0V | 0V | 0V |
| GSM TX | 3.6V | 0V | 3.6V | 0V | 0V | 2.8V |
| DCS RX | 0V | 3.6V | 3.6V | 0V | 2.8V | 0V |
| DCS TX | 0V | 3.6V | 0V | 3.6V | 2.8V | 2.8V |

5. The appropriate frequency is then fed out from U501 **Pin 5** (GSM) **GSM_RX** or from **Pin 7** (DCS) **DCS_RX**.

6. The received frequency is then fed into a Dual Band select SAW (Standing Acoustic Wave) filter U602 (Loss approximately 5dB). The GSM received frequency is then applied to the base of Low Noise amplifier Q601, with input matching supplied by C613 / L608 / C616 and the collector output matching elements supplied by C614 / L607 / C606. The support voltage for Q601 and Q602 is from TX / RX IC U603 (see Figure 1 for Block Schematic) **Pin 3** (**RFOUT**) and is 2.1V when active. The bias voltage that is approximately 1.4V will be used to switch the correct LNA *on* or *off* dependant upon band selected, or mode of operation.
   Q601 and Q602 are switched independently dependent upon the mode of the phone to save power, this is provided by the 3 signals **RXON1**, **RXON2** and **TXON**, U603 **Pins 44, 45 & 46** respectively. (These signals originate as **RXON**, **CALBRA** and **TXEN** from Gemini, **Pins 70, 69 & 118** respectively) The signal **BS**, U603 **Pin 35** selects the current operating band of the receiver. In addition, these signals allow the phone to go into 'Calibrate mode' in between Receiver timeslots to allow the gain of the PGA (Programmable Gain Amplifier) (this is internal to the IC) to be adjusted. It

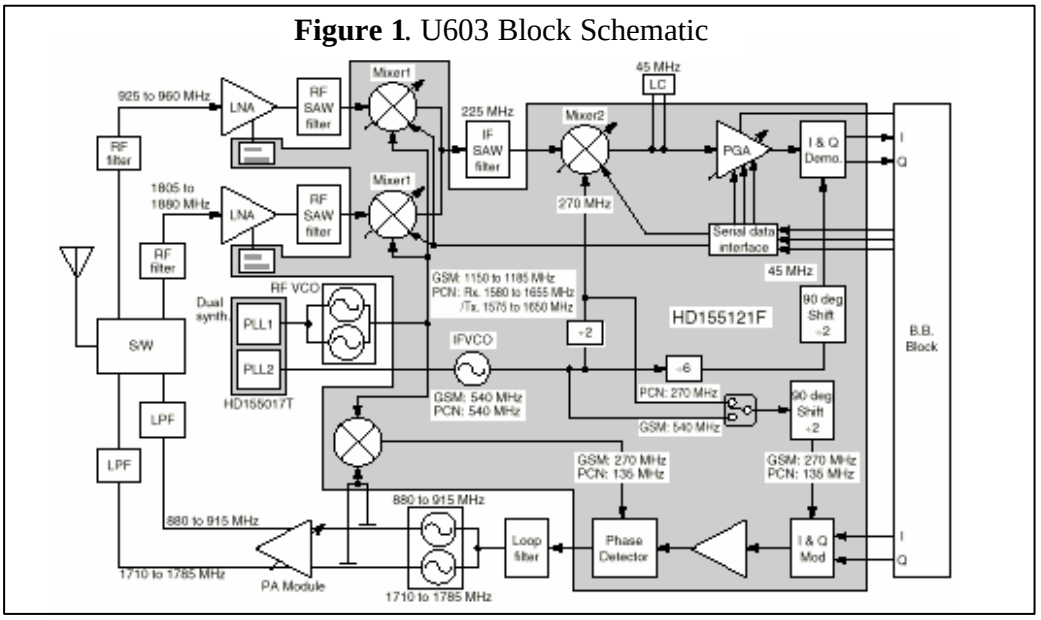
also allows the DC offsets of the IQ demodulator to be measured and then cancelled out. The below matrix shows the truth table for the signals involved and the states of the receiver path.

| | Receive | | Calibrate |
|---|---|---|---|
| | **GSM** | **DCS** | |
| RXON1 | H | H | L |
| RXON2<br>TXON | H<br>L | H<br>L | H<br>L |
| BS | L | H | Don't Care |
| LNA Bias (GSM) | ON | OFF | OFF |
| LNA Bias (DCS) | OFF | ON | OFF |
| 1st Mixer (GSM)<br>1st Mixer (DCS) | ON<br>OFF | OFF<br>ON | OFF<br>OFF |
| 2nd Mixer | ON | ON | ON |
| PGA | ON | ON | ON |
| I/Q Demodulator | ON | ON | ON |
| | | | |

**7.** The gain of the Low Noise Amplifiers is approximately 18dB. The amplified signal is then fed onto Dual Image rejection SAW (Standing Acoustic Wave) filter U601, an identical filter to U602. (Loss approximately 2dB).

**8.** The output is fed out of the filter on **Pin 7** for GSM and **Pin 5** for DCS, as an unbalanced output. The discrete circuitry C604 / C652 / C612 / L605 then split the signal into 2 balanced signals. (at approximately +11dB of input signal)

**Figure 1**. U603 Block Schematic



**9.** The balanced signal is then fed into U603 **Pins1&2** for GSM and **Pins 47 & 48** DCS. Within the U603 the received signal will now be mixed with the RX VCO to produce the 1st IF Frequency of 225.067Mhz. This signal is out put from U603 as a balanced 1st IF output on **Pins 42 & 43** (At approximately +25dB from input signal). These are output on the signal lines **MOX** and **MO.**

**10.** The RX VCO frequency is generated by the RX Dual Band Oscillator U401, which is controlled by the Frequency Synthesiser IC, IC401 (see page ??), this is fed into U603 on **Pin 39** (LO1)

**11.** Once the 1st IF frequency has been fed out, it is fed through Channel select SAW filter U604 on **Pins 1&2**, and fed back out on **Pins 7&8** the IF then re-enters U603 on **Pin 29**(IFINB) and **Pin 30** (IFIN). Internal to the U603, the 1st will now be down-converted to a 2nd IF.

**12.** The creation of the 2nd IF is achieved in the following way: A tuning voltage **IF_TUNE**, is sent from the Synthesiser IC, IC401 which drives the Varactor D601, at approximately 1.5V **IF_TUNE** will drive D601 to produce an output frequency of 540Mhz. This is then fed into U603 **Pin 33**.

**13.** Within the U603 the 540Mhz will be go through a 'Divide by 2' divider to give 270Mhz, this will be mixed with the incoming 1st IF of 225Mhz, to give a resultant 2nd IF of 45Mhz, this is then tuned by the 45Mhz tank Circuit consisting of C637 and L616. The 45Mhz signal carrying the modulation, will then be fed into a phase comparator, where it will be demodulated by a reference 45 MHz signal created form the 540Mhz signal which has passed through the 'divide by 2' and then though a 'divide by 6' divider.

**14.** We now have our balanced demodulated **RXI** and **RXQ** signals, which are fed out on **Pins 20, 21, 22 and 23** are fed to the VEGA IC on **Pins 51, 52, 53 & 54.**

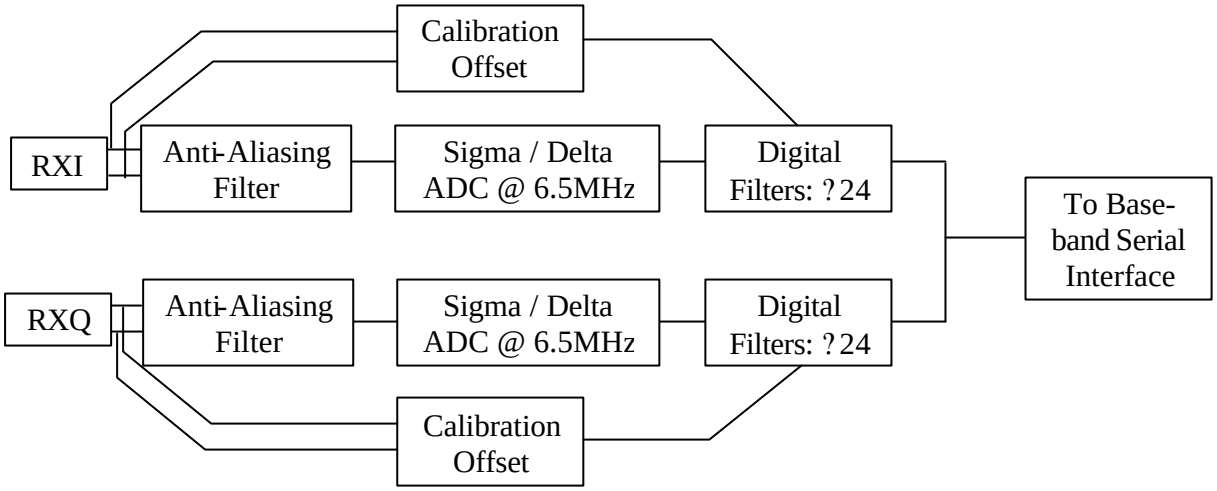
**15.** The VEGA IC is split into 3 sections:

- The Voice Processing portion of the IC includes the microphone and speaker amplifiers, ADC and DAC, speech digital filtering and a serial port.
- The Base-band processing section includes a 2-channel uplink and Downlink path, a serial port and a parallel port.
  The uplink path performs GMSK modulation, D/A Conversion and smoothing filters to provide the RF circuit with I & Q signals.
  The Downlink path performs anti-aliasing (this is where we filter out signals that are lower than our expected frequency, which are created through under sampling.) A/D Conversion and channel separation filtering of the I and Q signals. The serial port allows base-band data exchange with the DSP, with the Parallel port controlling timing signals.
- The VEGA also performs auxiliary RF functions such as AFC (Automatic Frequency Control) and AGC (Automatic Gain Control)



Motorola Proprietary Information

**16.** Within the VEGA IC the path of the base-band RXI & Q data from the TX / RX IC takes the following route.

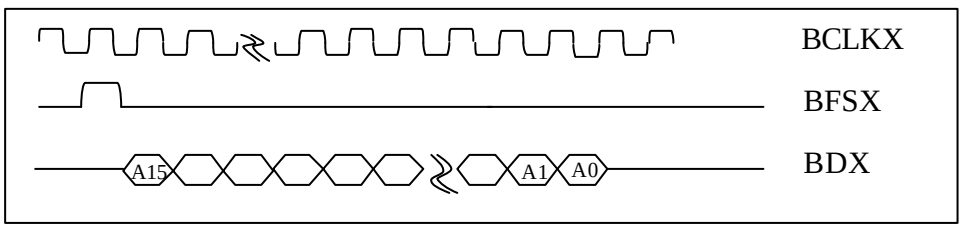



**17.** The RXI and Q signals from the RX/TX IC enter the VEGA IC (**BDLIP / BDLIN / BDLQP / BDLQN**) and follow identical paths. The first stage is through a continuous-time second order anti-aliasing filter, which serves 2 functions: 1) to interface between RF logic and on-chip circuitry and 2) to prevent aliasing during the ADC process.

**18.** The signal is then fed into a Sigma – Delta ADC sampling at 6.5MHz, and is fed out as a 3-bit word. This is then fed into a set of digital filters, that will decimate (break the signal into piece parts) to give us an overall sampling rate of 270.8KHz (?24). This gives us a low enough frequency for adjacent channel rejection and therefore channel separation.

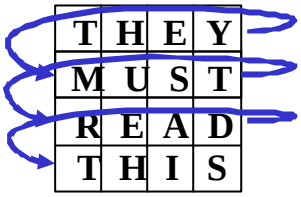
**19.** Calibration of the IQ paths is achieved by internally shorting out the 2 input I paths, and then the same again on the 2 input Q paths the digital value measured will then be stored in a register. Once the **RXI** and **Q** paths are reconnected to the circuitry, again the calibration process takes place and the offset value is calculated.

**20.** From the VEGA IC, the information is looped through to the GEMINI IC on the Base-band serial interface, consisting of **BDX**, (Base-band Data Transmit) **BCLKX** (Base-band Transmit Clock) and **BFSX** (Base-band Transmit Frame synch). See below for timing diagram:



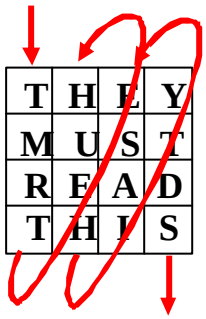
**21.** Within Gemini general GSM processing takes place, such as:

? **De-Interleaving**: Interleaving is a way in which the information that is to be transmitted is jumbled around before it is sent i.e.
If we wish to send the information 'They must read this'




And we lose the information during the time that 'must' is being sent. Then we will lose a whole word.

? However if we jumble the bits around that make up the words, i.e. transmit in a different order.




If now during the same time frame we lose the same amount of information, and then we will only lose a small part of each word

? **Channel De-Multiplexing** – this is where we decode the signal that was transmitted, encryption at the transmitter ends is usually done by X-ORing the information.

? **Forward Error Correction Decoding** – This is where the redundant bits of data that were added in the transmitter are removed, and the information that is received can be processed. The redundant bits are added in various quantities dependent upon the signal quality. This means if some data is lost whilst travelling OTA then, for example, instead of 8 bits of speech data being lost, only 4 bits of speech and 4 bits of redundant data.

? **De-Segmentation and CRC Attachment analysis**. – During the transmission process the data is broken into packets of various lengths (N$^{o}$ of bits). These packets are then processed to give a checksum of what should be expected at the receiver. Once in the GEMINI the information received is processed, and the two checksums compared. From the analysis, the correct algorithm for repairing any data corruption can be implemented.

**22.** The processed digital audio from the Gemini is then returned to the VEGA IC on the Voice-band serial interface **VDX** (GEMINI **Pin 85** to VEGA **Pin 14**) clock, **VCLKRX** and Frame synchronisation signal, **VFSRX**.

**23.** The processed digital audio is received from the Gemini at 8Khz, from here the signal is interpolated within a speech-digital infinite duration impulse response filter (IIR) (i.e. that is, for the data coming in, the adjacent bits of the data being looked at are all synchronised and an average taken. From this a prediction of events can be calculated) also the sampling rate is increased to 1Mhz and the speech bandwidth is limited by high and Low pass responses.

**24.** The signal is then fed into a Sigma-Delta Modulator for D/A conversion this will then give a 1 bit over-sampled signal

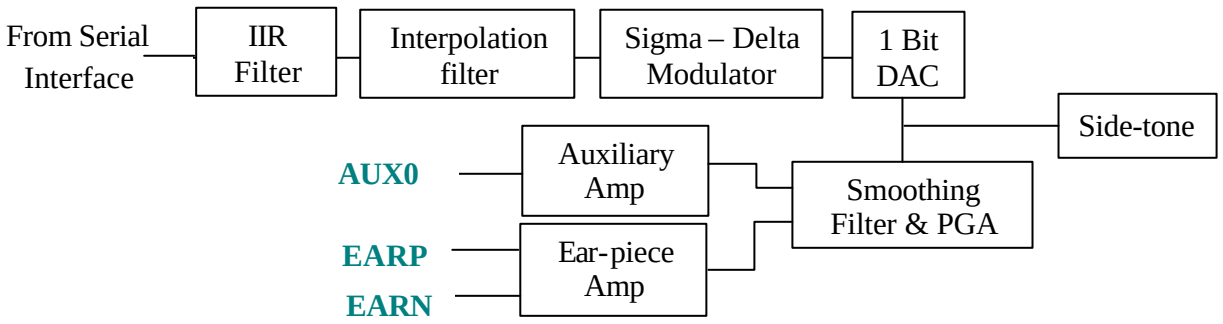
**25.** This over-sampled signal (we over-sample to allow much cheaper and easier reconstruction of the received signal) is now D/A'd and a high frequency noise tone is injected into the signal. This noise will be used for programming the PGA. There are 7 programmable gains and 1 mute function.

**26.** The noise is then removed in a smoothing filter and the appropriate gains or attenuations made.

**27.** The converted speech can then take 1 of 2 paths.

**28.** Path 1 to the Internal speaker LS1, the audio is fed out of the VEGA on **Pins 32 & 33**, and fed directly to the speaker, voltage suppressers U4 and U5 are responsible for ESD protection. The speaker is situated in the front housing of the unit and is connected to the main PCB through 2 contact springs.

**29.** Path 2 to an External Speaker, the audio is fed out from the VEGA IC on **Pin 34 AUXO**, it passes through Connector 3, J10 which is a jumper connector for JTAG purposes. From here it is fed to **Pin 4** of the External Connector J40.



## TRANSMIT

**30.** There are 2 sources of input audio:

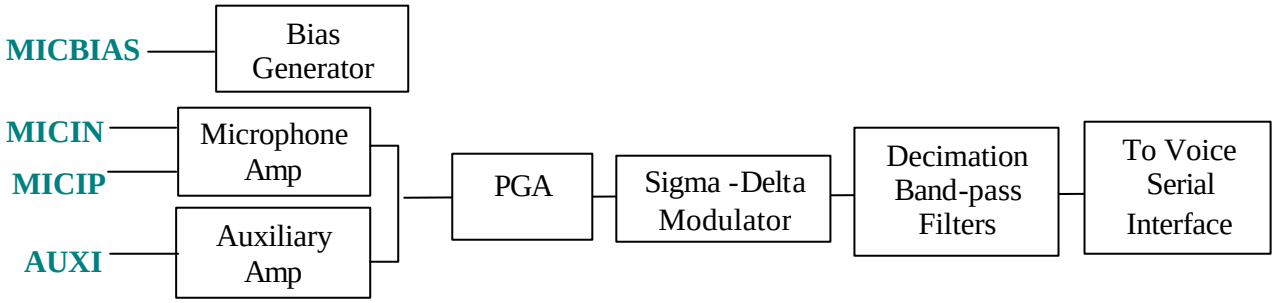
**31.** Auxiliary Microphone is fed in through J40 External Connector **Pin1** and is fed through Jumper Connector J8 (JTAG Use), and is amplified through the BQ5 circuit, supported by the voltage **DVCC**. The input signal is fed onto the base of Audio AmpBQ5, amplified, and fed out of the collector as **AUXI**.

**32.** The Internal Microphone X1, uses the circuit R14 / R15 / C22 / C23 / R17 / R18 to provide microphone biasing, the biasing support voltage being fed from the VEGA IC from **Pin 26**. (Gain approximately 27dBm)Voltage suppressers U48 and U49 provide ESD protection to the circuit.

**33.** If both inputs are active then, output signal from the internal microphone will be used.

**34.** The input analogue audio is then routed to the VEGA IC **Pins 28 & 29**. Within the VEGA the analogue signal will be driven through a PGA with a gain of between –12dB to +12dB in 1dB steps.

**35.** A Sigma-Delta Modulator converts the signal from analogue to Digital, sampled at 1Mhz. The signal is the decimated and the sampling rate taken down to signal samples at 8Khz.




**36.** Once again, as in **RECEIVE**, the loop between the VEGA IC and the GEMINI IC is put in place for standard data processing.

**37.** The transmitted signal is sent to the Gemini IC over the Voice-band **VDR** Line VEGA **Pin 14** and is clocked by **VCLKRX** **Pin 16**. The signals are then received by the Gemini IC on **Pins 97 & 98** respectively. Synchronisation is achieved using the frame synch signal **VFSRX** (VEGA **Pin 13** / GEMINI **Pin 96**.

**38.** After processing, the Base-band signal information is transferred back to the VEGA IC using the base-band lines, **BFSR / BDR / BCLKR** / (VEGA **Pins 6, 4 & 5** and GEMINI **Pins 74 / 75 / 76** respectively)

**39.** Within the VEGA IC, the received information will now be modulated by GMSK.

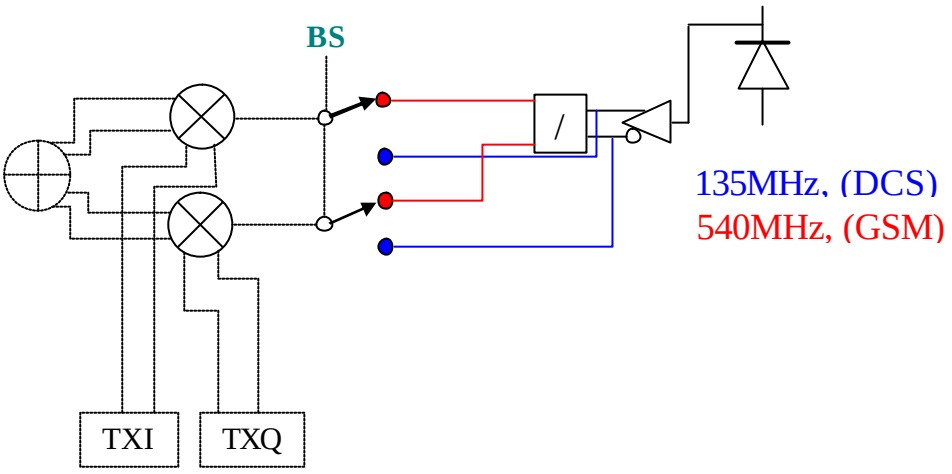
**40.** The processed information is sent along the Serial Base-band interface, and is fed into a register before being differentially encoded. The encoded signal is then applied to a Sin / Cosine look up ROM where the GMSK TX I & Q 'words' are generated (interpolation ratio of 16)

**41.** The I & Q words are the sampled at 4.33Mhz (16 X 270Khz) and applied to a high speed 8 bit digital to Analogue converter, any image frequencies created during this process will be removed by a subsequent Bessel Filter.

**42.** The burst length will be determined by the pulse width of **BENA Pin 71** (when **BULON** is active **Pin 74**, actual effective transmission burst length = **BENA** +32 ¼ bits)

**43.** Calibration of **TXI & Q** paths can be set during the **BCAL** timing window.

**44.** The analogue information, is now sent from VEGA **Pins 57 – 60**, to the TX / RX IC on the **TX I & Q** lines **Pins 13 – 16**




**45.** The signal routing for the **TX I & Q** through the TX / RX IC is as follows:

**46.** The **TXI & Q** signals are routed to 2 modulators. At the same time, from the Varactor D601, the 540Mhz signal, as produced in RECEIVE, is injected into the TX / RX IC on **Pin 33**, the signal is then amplified and divided by 2 (for GSM).

**47.** The 270MHz is then fed into a band select switch, and onto a phase splitter / shifter which contains a $90^{o}$ offset circuit. The resultant signal is then fed into the 2 modulators to be modulated by the TXI & Q data.



Motorola Proprietary Information

**48.** These 2 paths are then summed to give a single IF modulated signal, which is then amplified.

**49.** From here the output current used to drive the TXVCO will be generated. The feedback from the TXVCO (DCS or GSM) is mixed with the RXVCO frequency to produce a reference frequency of 270Mhz. This is then mixed with the modulated IF with the phase comparator giving an output proportional to the difference between the phase vales of the 2 frequencies.

**50.** This output current is fed out on TX / RX IC **Pin 11** (**PLLOUT**). R614 is used to control the current out from **PLLOUT**.

**51.** The VCO driving current is then passed through the loop filter made up of R626 and R627, C645 and C647. (C647 is a polyester capacitor used to ensure low noise). The purpose of the loop filter is to prevent any overshoots due to channel changes, being transmitted to the TXVCO. The TXVCO driving voltage is between 0.8V – 2.0V.

**52.** The drive current is fed into the TXVCO U606 on **Pin 6**, with the TX frequency being fed out on **Pin 1**. The voltage **TX2V8**, which is switched by the signal **TXVCO_OFF**, supports the TXVCO. The signal **BS** **Pin 5** controls whether the TXVCO produces a DCS or GSM output.

**53.** As the TXVCO produces both GSM900 or DCS1800 frequencies from the same output line, the signal must be fed into a diplexer U605, this circuit uses inductive properties to effectively delay 1 frequency compared to the other and therefore split the paths, between the GSM and DCS frequencies.

**54.** The output frequency then takes 2 paths:

**55.** Path 1: The output signal is attenuated through R615-R622, coupled through C631 and C632 and fed into the TX /RX IC on **Pin 8** (DCS) and **Pin 9** (GSM). This will then be used as the feedback for the TXVCO Phase lock loop as discussed in point 49.

**56.** Path 2: The signal is output as **TX_GSM** or **TX_DCS** to the PA.

**57.** The PA U201 is a Dual package three stage PA that is split into the GSM and DCS part. The supply for the PA is **VBAT** 3.6V(depends on battery charge level) on **Pin 6** (front stage) and **Pin 8** (back stage).

**58.** Band selection is done with **BS** (Band Select). DCS high and GSM low level. Signal inputs on pin 2 and 4 from the TXVCO diplexer **U605** are **TXDCS** and **TXGSM.** Amplified outputs are **Pins 10 and 12**.

**59.** Power Control is achieved in the following way:

**60.** **RAMP** is connected to the Gain Control circuit U202 **Pin 3**. This is the positive input of the comparator. This is the same ideology as the AOC line in Whitecap products. **VBAT** is connected to the negative comparator input on **Pin 4** to compare changes on the battery level that causes lower or higher gain of the PA
Output of the Comparator U202 is the signal **APC** (Automatic Power Control) **Pin 1** that drives the gain input of the PA U201 **Pin 14**. This is fed through Q202, which is implemented as a safety latch. In TX Mode, the right side of Q202 is biased on from VBAT on Pin 4; this allows the APC voltage to vary the PA Drive.
In TX Background mode or RX mode, PA_ON is low, this shorts the left side of R298 (VBAT) is shorted to Earth.
**APC** is also controlled in unison with the handset temperature. Thermister TR1 (which is supported by the voltage **AVCC**) gives a voltage reading, which is proportional to the current handset temperature. This is fed back to VEGA **Pin 40**. As the temperature goes up the APC line is backed down slightly.

**61.** Sensing the high current flow to the PA back stage, Pin 8, controls the PA power saturation. The Sense Resistor, R203 **(**0.033 ohm) is used to sense the voltage variations on the VBAT line when the PA draws more or less current and is connected to **Pin 4** of Q201. The transistor is biased on using VBAT (Pin 5) and the change in voltage over the sense resistor is throughput from Pin 4 to Pin 3. From here it will vary the non-inverting input of U202 therefore changing the APC level.

**62.** Expected DC level at **Pin 3** Q201 is 3.4V for PA off, 3.3V for Power step 15 and 3.2V for power step 5.

**63.** The second part of Q201 **Pin 1 to 3** is used to inverse the **TXON** on signal as **TXVCO_OFF** to switch Q603.
If **TXVCO_OFF** is low the TX VCO is on.

**64.** From the PA, the RF is fed out to the RF Switch U501 on **Pins 1** (GSM) **GSMPA**, or **Pin 11 DCSPA**. The operation of the RF Switch is explained in Point 4.

**65.** The appropriate RF signal will then be fed out to either the Antenna ANT 1 or to the Auxiliary RF connector U113.

## Synthesiser IC IC401

**66.** The synthesiser IC is responsible for outputting control signals to both the RX and TX VCO's. The IC is divided into an IF section **Pins 2 - 7** and an RF Section **Pins 8 – 12.**

**67.** Before any outputs from the IC can be used a reference must be made available. For this we use the system clock. This clock is a 13Mhz clock which is generated in the 13Mhz crystal oscillator, the tuning voltage is generated as the signal **AFC** from the

VEGA IC and has a range of approximately 1.2V – 1.5V. The Oscillator supply is generated from the Base-band Voltage Regulator U27 **Pin 24** (VTCXO 2.8V). The 13Mhz is buffered by IC402 before being O/P as 13MHz to VEGA for use as the system clock.

**68.** At the same time it is input to the Synthesiser IC on **Pin 1** OSCin, from here the IF tuning voltage **IF_TUNE** as spoken about in points 12 (RECEIVE) and 46 (TRANSMIT) to drive the 540 / 135MHz Varactor diode.

**69.** All the controlling signals for the IC are generated from Gemini and enter on Pin 14 DATA, the signals are clocked in (**Pin 15 CLK**) and the IC is enabled using the control logic **SYNPRG** on **Pin 13**(**LE**)

**70.** The IF Support voltage for the IC is **SYN2V8**, a 2.8V support, generated in the RF Voltage Regulator **IC301 Pin 2** (**OUTC**). A sample of this voltage is taken to ensure the synthesiser IC is switched off during idle time. This sample is fed into **Pins 6** and **7**.

**71.** The Feedback from the 540 / 135MHz Varactor diode is returned to the IC as the signal **LO2** and is fed in on **Pin 3** (**finif**). To complete the phase lock loop.

**72.** On the RF side, the supporting voltage is again **SYN2V8** and enters on **Pin 11** (**vccrf**). The charge pump output for the TXVCO is fed out on **Pin 8** (**Dorf**) to the RXVCO U401 **Pin 3**. U401 is supported by **SYN2V8**.

**73.** The band select signal **BS** enters U401 on **Pin 4** and will select the appropriate output to either GSM or DCS on **Pin 1**. The output will then be fed out to the TX / RX IC as **LO1** to create the 1st IF, and also a sample will be fed back into the Synthesiser IC to provide Phase Lock Loop feedback.

**Power up Sequence**

**74.** The main core of the power up sequence next to the operating software is the Power Management IC U27. U27 contains 4 Voltage regulators.

- **DVCC** – 2.765V @ 100mA and provides the Base-band logic supplies. **Pin 2**
- **AVCC** – 2.765V @ 130mA and provides for analogue voltage supplies**. Pin 27**
- **VTCXO** – 2.765V @ 5mA – for use to drive the system 13Mhz clock. **Pin 24**
- **VRTC** – To charge to the Real Time Clock battery U32 (when battery voltage falls below 1.2V). **Pin 8**

**75.** The battery voltage **VBAT** on Pin 1 supplies U27.

**76.** Once power is supplied to the unit, there are a number of ways that the unit can be powered up. The input pulse is a 40mS +ve going pulse through U53 and U54 and onto U27 inputs **Pins 4&5**,

These are:

- ? Power on generated by set alarm, which is generated from the RTC (the alarm is set into the menu structure of the phone). U54 **Pin 2**
- ? **IO2**, software originated power on from Gemini **Pin 112**. U54 **Pin 1**
- ? From depressing the Power On key giving the signal **PWR**. U53 **Pin 2**
- ? From the External Charger (**CHGERP**). U53 **Pin 1**

**77.** As the unit begins to power up the reset signal is generated, again a +ve going signal. Charging C57 generates the charge for the reset signal.

**78.** As for the GCAP the Power Control IC also interfaces with the SIM Card, VCC for the SIM card is provided by **Pin 20**, onto SIM Block **Pins 4 & 5**. However the occasional need for 5V SIM is provided using the input from the scaled **DVCC** on **Pin 17** and the charge pump C53 **Pins 21 & 9**.

**79.** Data is read from the SIM card on **pin 2** of the SIM block I/O into U27 **Pin 15** (**IO**) and transmitted to the Gemini from U27 **Pin 11** (**S-IO**). Also from Gemini are the SIM CLK U27 **Pin 13**[**in**] & **Pin 19** [**out**] (SIM Block **Pin 1**) and the SIM Reset U27 **Pin 12** [**in**] and **Pin 16** [**out**] (SIM Block **Pin 3)**

**80.** **SIM I/O** also acts as a SIM Presence detect signal.

**81.** Power for the unit can be taken from either internal Battery or from an external source. The battery has 4 contacts, from battery connector JP2

- ? **Pin 1** Supplies **VBAT** directly
- ? **Pin 2** **BATEMP** is used to monitor Battery temperature during charging, and is fed to VEGA for A / D processing.
- ? **Pin 3** **BAID** is Battery ID and is used for the detection of different types of batteries.
- ? **Pin4** is ground

Alternatively the **VBAT** source can be taken from an external power source, this originates at the I/O connector U40 **Pin A3**, with U36 providing ESD protection, the signal is then fed as **CHGERP**, and through Fuse F1. As mentioned in Point 76 this will ensure the unit powers up but will also pass through BQ3 and protection diode D14 to provide **VBAT**. D15 limits input voltage to <6V

**82.** U30 is used to detect the charger and is supported by **DVCC**, once detected an interrupt is sent to Gemini as **IO9**

**83.** For the Initial charge at low battery voltage, as before the input voltage at **CHGERP** is approximately 6V, **CHGERP** originates at U40 **Pin T3** with **T1** as its respective Ground

**84.** NOT**E:** If a desktop charger then **I06** is used to communicate to the Gemini the status of the charging indicator on the charger.

**85.** This will began to charge the battery through BQ3. (BQ3 fully open) The voltage divider R111 and R112 puts a voltage of 4V onto the source of BQ6. During this time C81 will be charged (approximate charging time is 3 – 5 Seconds.

**86.** When the charge in C81 reaches 4V the, the S-G bias on BQ6 will be 0V, which will effectively turn off BQ6, this in turn has the effect to switch Charging Control IC U29 off which will turn off BQ3.

**87.** For Normal charge the phased charging values stored in the EEprom will be D/A'd then sent as signal **IO11** which will control the gate of Charging Control IC U29 which will vary the gate of BQ3. This allows us to vary the charge onto the battery.

**88.** An exception to the above exists if a car kit is being used in which case, Ext. Power will be input into the phone on the I/O connector **Pin 11**, with U19 provide ESD protection as the signal **IOPN11**.

**89.** It will then be fed through Fuse F2, and onto the source (S1) of Dual FET U26, the amount of current that is passed through to **VBAT** is controlled via software **IO1** by U25

**90.** For Power output when using the data cable, **VBAT** is fed onto the source (S2) of U26, with U29 providing gate bias. D12 is forward biased for this 1 application.

**91.** The real time clock is generated by crystal X2 and runs at 32.768MHz. It is driven by the charge pump from U46 **Pin 1** (**OSC1**).
Synchronisation is achieved by **IO14**, which is clock generated by Gemini **pin 50**, with the IC enabled by Chip Enable **RTCCE** Gemini **Pin 117.**
The re-chargeable RTC battery U32 provides power for U46. As mentioned in Point 74.
**Pin3 nINT** provides the alarm interrupt to power the unit on at a specified time.

**92.** U47 is the 1.8V regulator used to Power Gemini, supported by **VBAT** and is powered on at the same time as the Power Control IC U27 (**Pin 1 CTRL**) and is supported by VBAT. The 1.8V regulated voltage is fed out to the Gemini as **PVCC18**.

**Memory**

**93.** Flash U23 is split into Operating Software memory 12Mbit and EEprom Memory 4Mbit. Supported by **DVCC** on **Pin G4**. Chip enable **NROMCS** (N signifies active low) from Gemini **Pin 17** onto Flash **Pin F1**. Boot-code is contained within the IC **NFOE**, **Pin G1** (Active Low Flash Output Enable) is used to instruct Flash that Gemini want to read or write form the device. **DLPWR** is not used.

**94.** SRAM U22 is a 2Mbit device, supported by **DVCC** on **Pin E1**. SRAM is Chip enabled by **NRAMCS** **Pin G3**.

**Display**

**95.** The LCD module is a 98 X 64, Chip on Glass device and measures 37 x 33mm with a polyamide foil connection to the PCB through U24. Support for the LCD is through **DVCC**.

**96.** Contrast control is achieved by the variation in voltages, which are stored in C40 through C44 and DC / DC LCD driving voltages provided by C45 through C48.

**97.** Data to and from the LCD is though the data bus **D0 – D7**, U24 **Pins 16 – 24**

**98.** Chip select is sent from Gemini **Pin 48** to LCD Connector **Pin 28**, with the **Reset** on connector on **Pin 27**.

**Vibrator and Alert**

**99.** The vibrator is driven by the signal **AAGC** which originates from VEGA **Pin 45**, this signal is applied to the base of Dual NPN / PnP transistor U44, this then causes the second transistor to conduct forcing the collector high. This then effectively give s the vibrator support voltage **VBAT** a path to earth through BQ1

**100.** U6 provide EMF protection.

**101.** The buzzer / alert is operated, using the signal **BUZZER** from Gemini **Pin 20**, this signal forces BQ4 to conduct creating the current path for the buzzer U8 support voltage **VBAT** to earth.

**102.** U7 Provides EMF protection for the buzzer.

**Keypad and Back lights**

**103.** The backlights are split into 3 for the LCD (D1 – D3) and the keypad backlights of which there are 8 (D4 – D11). The backlights are switched on using the signal **LEDON** (This is generated from Keypad detect switch U34 and is switched by the signal **BL** from Gemini **Pin 134**. **LEDON** then forces BQ2 to conduct allowing the support voltage **VBAT** to illuminate the backlights.

**104.** The keypad is made up of a 4 column x 5 Row matrix, with the **signals ROW4 – ROW 0** being generated from Gemini **Pins 126 to Pins 122** respectively. The column signals, **COL3** Gemini **Pin 129**, **COL2 Pin 128**, **COL1 Pin 133** & **COL0 Pin 132**.

**105.** The 2 signals **ROW4** and **COL4** are used as outputs from the Gemini to Keypad detect switch U34 to inform the unit to switch on during sleep mode.

**106.** The keypad matrix is as follows:

| Function | Key | COL0 | COL1 | COL2 | COL3 | ROW 0 | ROW 1 | ROW 2 | ROW 3 | ROW 4 |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| **2** | S1 | | | | 0 | | | | | 0 |
| ***** | S2 | | | | 0 | | | | 0 | |
| **7** | S3 | | | | 0 | | | 0 | | |
| **4** | S4 | | | | 0 | | 0 | | | |
| **1** | S5 | | | | 0 | 0 | | | | |
| **6** | S6 | | | 0 | | | | | | 0 |
| **3** | S7 | | | 0 | | | | | 0 | |
| **0** | S8 | | | 0 | | | | 0 | | |
| **8** | S9 | | | 0 | | | 0 | | | |
| **5** | S10 | | | 0 | | 0 | | | | |
| **LEFT** | S11 | | 0 | | | | | | 0 | |
| **RIGHT** | S12 | | 0 | | | | | 0 | | |
| **#** | S13 | | 0 | | | | 0 | | | |
| **9** | S14 | | 0 | | | 0 | | | | |
| **YES** | S15 | 0 | | | | 0 | | | | |
| **NO / CLR / PWR** | S16 | No Matrix used S16 switches VBAT directly onto the PWR signal to power up the unit. | | | | | | | | |
| **CLEAR** | S17 | | 0 | | | | | | | 0 |

# Unique Differences Between Acer T2688 and Acer T2988

LCD holder - 42.G0119.001

Key Pad - 42.G0118.001

Volume Key - 60.G0123.001

Front/Housing listed below

60.G0122.011 (Dark Blue or Electric Blue)
60.G0122.021 (Light Green or Misty Green)
60.G0122.031 (Light Blue or Teal ice)
60.G0122.041 (Copper Orange)

There is no other hardware difference to the product. PCB is the same and other mechanical parts are the same.

Software is different – Version 3.X is Refresh software with additional features for T2988 (Asia) and T200 (EMEA)

Additional features covered are

1. WAP
2. Quick Access Interface
3. QuickNotes (Pre-stored/User Definable SMS Message).
4. Scheduled Power On/Off
5. Thai and Vietnamese prompt
6. SIM Lock ( Network Lock)

Software version 1.X or 2.X is used on T2688 does not have the above function

GSM Service Support Level 3 Authorized

Dual Band Topaz

ANT 1

CALIBRATION RF PORT

U113

CONTROL SWITCH U502 (VC1, VC2, VC3, VC4)

PA_ON

IC501

BS

VBAT

DIPLEXER

U501

CONTROL FUNCTION

935-960MHz GSM_RX

1805-1880MHz DCS_RX

TX / RX Switch

DCSPA

GSMPA

RX MID CHANNELS
GSM: CH 62 -- 947,4 MHz
DCS: CH 700 -- 1842,8MHz

U602

Q601

Q602

U601

GSM_RX

DCS_RX

RFIN1

RFIN2

RF_OUT

VTCXO From U27 Power Management IC

1,2-1,5V AFC From VEGA

U402

SYNPRG From Gemmini

IC402

13MHz to Gemmini & Vega

TX VCO FRQ. RANGE
GSM: 890-915Mhz
DCS: 1710-1785Mhz

TX VCO MID CHANNELS
GSM: CH 62 -- 902.4MHz
DCS: CH 700 -- 1747.8Mhz

SYNTHESISER IC IC401

DATA, SYNPRG, CLOCK

SYN2V8 from IC901

LO2 From U603

IF_TUNE To U603

LO1

GSM - 124 Channels
25MHz B/W
200Khz Spacing

RX VCO MID CHANNELS
GSM: CH 62 -- 1172.4MHz
DCS: CH 700 -- 1612.8MHz

RX VCO FRQ. RANGE
GSM:1335 - 1359Mhz
DCS: 1580 - 1655MHz

U401 RX VCO

SYN2V8

TXON

VBAT

TXVCO_OFF

R208

R203 0.033Ohm

R209

Q201

TX_GSM

TX_DCS

U201 PA

U605 Diplexer

BS

U606 TX VCO

TX2V8

Q202

PA_ON

R298

RAMP From VEGA (RAMPDA)

U202 PA CONTROL

TX LOOP FILTER

This line is Internal to the TX/RX IC

AGCPRG From Gemini

DATA

CLK

Serial Interface

TX FRQ. RANGE
DCS: 1710-1785MHz
PCS:1850-1910MHz

From VSYNEN (Gemini)

RF POWER SUPPLY IC901

VBAT, RF_ON

TX2V8, SYN2V8, RF2V8

TX / RX IC U603 HD155121F

Control Logic

TX_ON, RXON1, RXON2, BS — From GEMINI

See Circuit description Page 2 for Logic Control truth table.

IF_TUNE From Synthesiser

540MHz@GSM
135Mhz@DCS

D601

LO2 To Synthesiser

225 MHz

U604

45 MHz

LC TANK

270 MHz

45MHz

PGA

90 deg

45 MHz

RXI To VEGA

RXQ To VEGA

GSM

DCS GSM

DCS

90°

270MHz@GSM
135Mhz@DCS

From VEGA TXI

TXQ From VEGA

SEE PAGE 8 / 9 OF LEVEL 3 CIRCUIT DESCRIPTION

RF2V8

| | |
|---|---|
| GSM SERVICE SUPPORT GROUP | 01.01.11 |
| LEVEL 3 RF Block Diagram | Rev. 1.3 |
| Dual Band Topaz | |
| **Michael Hansen, Ray Collins, Ralf Lorenzen-Scheil** | Page 1 of 2 |

RX SIGNAL PATH
TX SIGNAL PATH
MAIN VCO SIGNAL PATH
TUNING VOLTAGES
REFERENCE CLOCK
Orderable Part
Non - Orderable Part

# Dual Band Topaz

## GEMINI

RIF
SIM Interface
DSP CORE (LEAD)
ARM Peripheral Interface (APIF)
ARM 7 Central RISC Processing Unit
Time Processing Unit
ACT
TSP
I/O General Purpose
U Wire
Memory Interface
**U1**

(AGCPRG) AGCA
ACCIN
(CLOCK) SYNCLK
(DATA) SYNDAT
(SYNPRG) SYNENA
BS
AGCPRG To TX / RX IC
SYNPRG To Synthesiser
To U27 Power Management IC: S_I/O, S_RST, S_PWST, S_CLK, S-3V5V
IO6
From Charger CCt IO9
To Charger CCt IO11
BUZZER
ALRT U8
VBAT
BQ4
To RTC IC U46: IO14, RTCCE
TO RF_ON (RF PSU) VSYNEN
ROW0,1, 2, 3, 4
COL0,1, 2, 3
COL4
PA_ON
BCLKR, BDR, BFSR To VEGA
VFSRX, VCLKRX, VDX To / From VEGA
VDR From Vega
BFSX, BCLKX, BDX From VEGA
13MHz From U402
13MHz, TX_ON, RXON1, RXON2 To U603
IO2 To On Control
NRAMCS
NROMCS
RNW
NFOE
DTATID
NCSO
NRESET
RS232 Signalling
PVCC18
A0 To Display
110 - 114 & 105

## U40
20 PIN I / O CONN.

13 ACCIN
2 Not Used
3 JTAG Only
9 DATAID Identifies DATA service To Gemini
A2 IO6 (DTR) To Gemini
10
5, 6, 7, 8
A3 CHGERP
B2
11 IOPN11 To Charger Circuit
13 ACCIN
12 ACCID
14 GND
A1
B1
B3 NC
1 AUXI
4 AUX0

VEGA / GEMINI COMMUNICATION BUS
RS232 Signalling
To Display
NRESET

## VEGA

DSP Serial Interface
MCU Serial Interface
Baseband Uplink — SEE PAGE 8 OF THE LEVEL 3 CIRCUIT DESCRIPTION
Timing Module
Baseband Downlink — SEE PAGE 4 OF THE LEVEL 3 CIRCUIT DESCRIPTION
Voiceband Serial Interface
Bus Controller
DAI Interface
Voice Uplink — SEE PAGE 7 OF THE LEVEL 3 CIRCUIT DESCRIPTION
Voice Downlink — SEE PAGE 6 OF THE LEVEL 3 CIRCUIT DESCRIPTION
AGC
Auxiliary ADC
Supply & Ground
**U3**

BFSR, BCLKR, BDR, BFSX, BCLKX, BDX From / To GEMINI
TXI, TXI, TXQ, TXQ To U603
13MHz
RXI, RXI, RXQ, RXQ From U603
VFSRX, VCLKRX, VDX From GEMINI
VFSRX, VCLKRX, VDR To GEMINI
RAMPDA To U202 (RAMP)
AFC To 13Mhz Clock Cct
BATEMP, BATID From Batt
CHGERP From I / O Connector
DVCC
AVCC
ACCID
IOPN11 From I / O Connector Pin 11 U40
LS1 SPKR
VIBRATOR
X1 MIC
J8
J10
AUXI
AUX0
DVCC
U44
BQ1
F1
F2
D12
U26
U25
U29
TR1
U30
BQ6
D16
C81
BQ3
D14
BATTERY JP2
BATEMP
BATID
To VEGA

## U22 SRAM
2 Mbit A3, G2, G3, B3
DVCC
NRAMCS
RNW

## U23 FLASH
12Mbit F6,G4, G1, F1
$E^2$ 4 Mbit B4, A4
DVCC
NFOE
NROMCS
RNW
NRESET

ADDRESS BUS
DATA BUS
ADDRESS BUS
DATA BUS

## U24
Contrast Cntl
LCD Drvr
DATA Bus
DVCC
RNW
NRESET
LCDRST
NCSO
A0

## KEYPAD MATRIX
ROW0
ROW1
ROW2
ROW3
ROW4
COL0
COL1
COL2
COL3

From Gemini ROW4
From Gemini COL4
U34
LEDON
BQ2
VBAT
LCD Backlights
Keypad Backlights
PWR
S16
VBAT

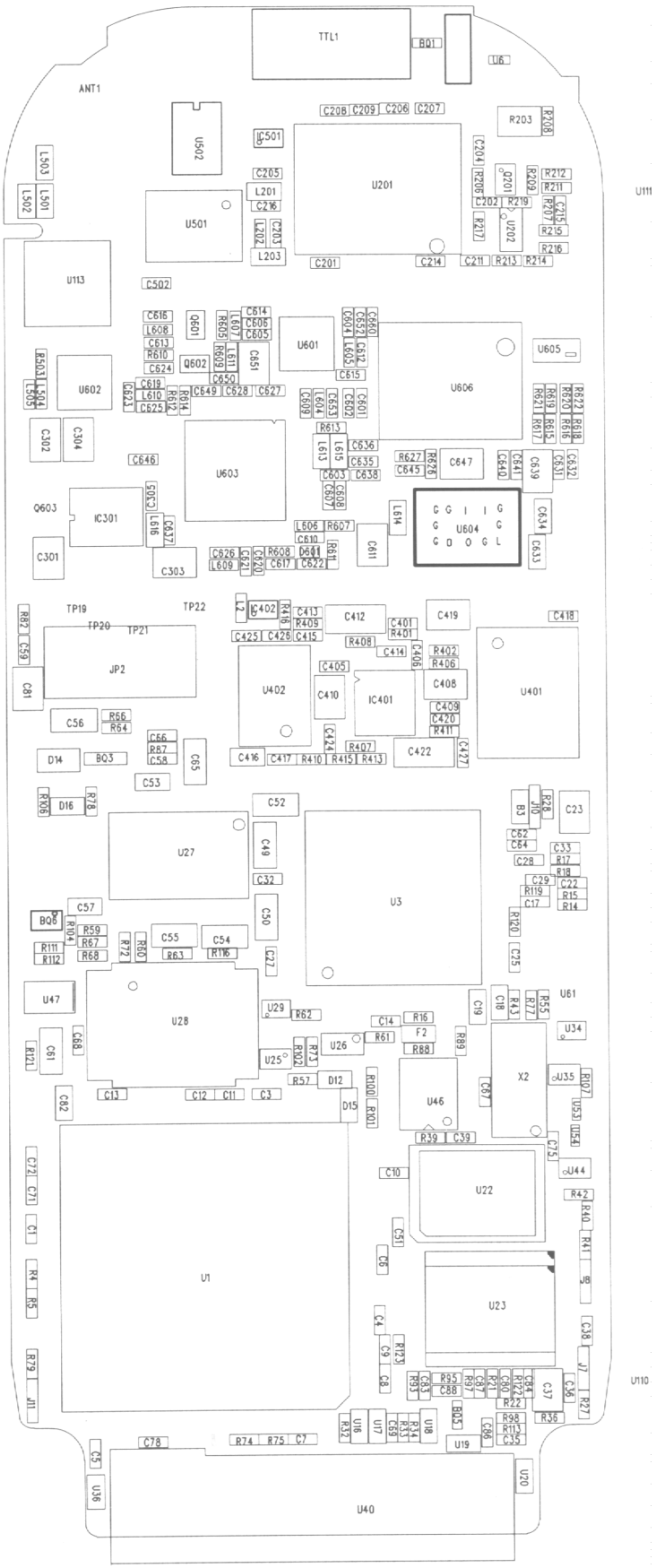
## U27
POWER MANAGEMENT IC
To Gemini: S_I/O, S_RST, S_CLK, S_PWST, S_3V5V
DVCC Baseband
AVCC Analog
VTCXO 13MHz
VRTC
RTC
Voltage Reg 2.765V@100mA
Voltage Reg 2.765V@130mA
Voltage Reg 2.765V@5mA
Voltage Reg
SIM Interface
I/O
SIM_PD& SIM I/O
CLK
RST
VSIM
U28 SIM
LCDRST

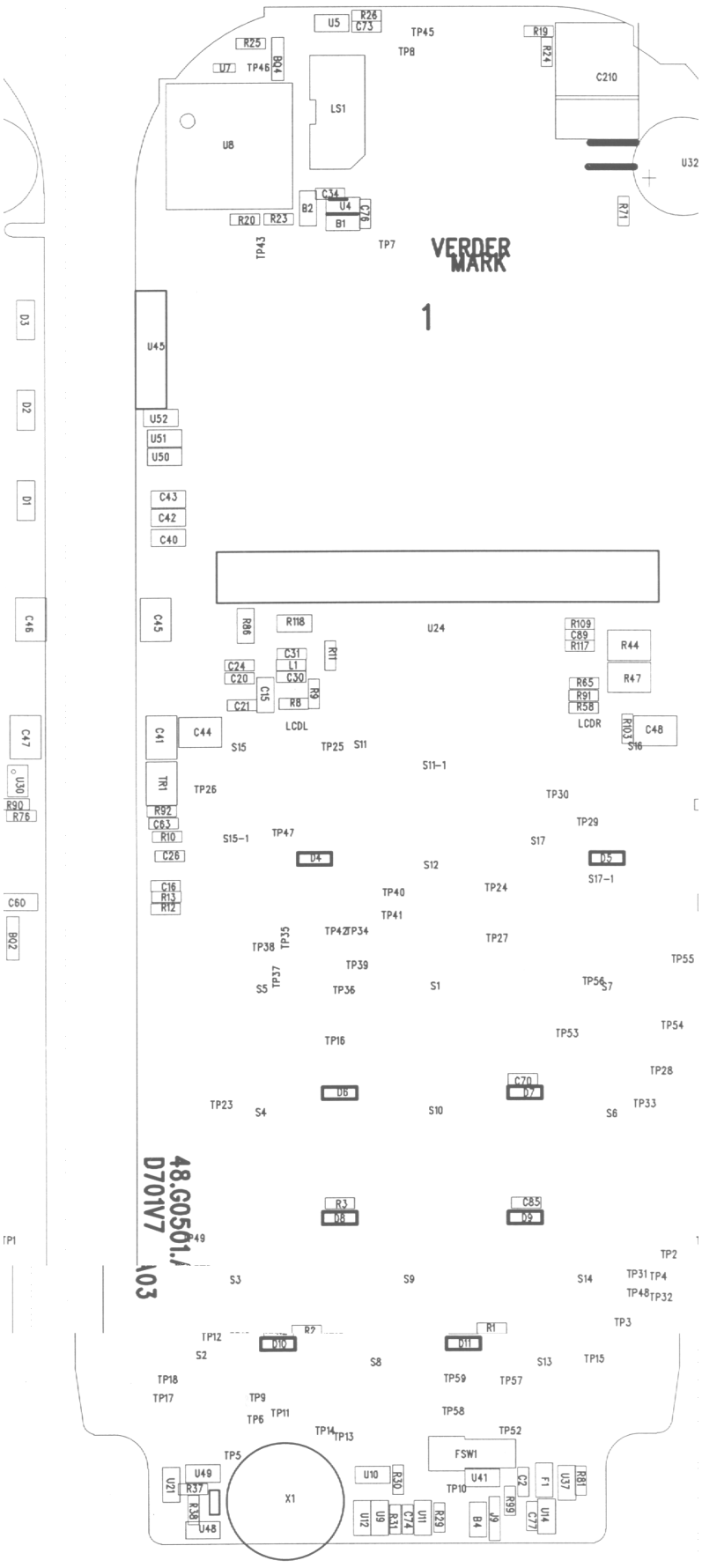
VBAT
RTC BATT
U32
X2
U46
IO14
RTCCE
From Gemini
Control Logic
U53
U54
U35
U47
PWR
IO2 From Gemini
To Gemini PVCC18
for detection To Gemini IO9
IO11 From Gemini
Data Cable

GSM Service Support
Level 3 Authorized

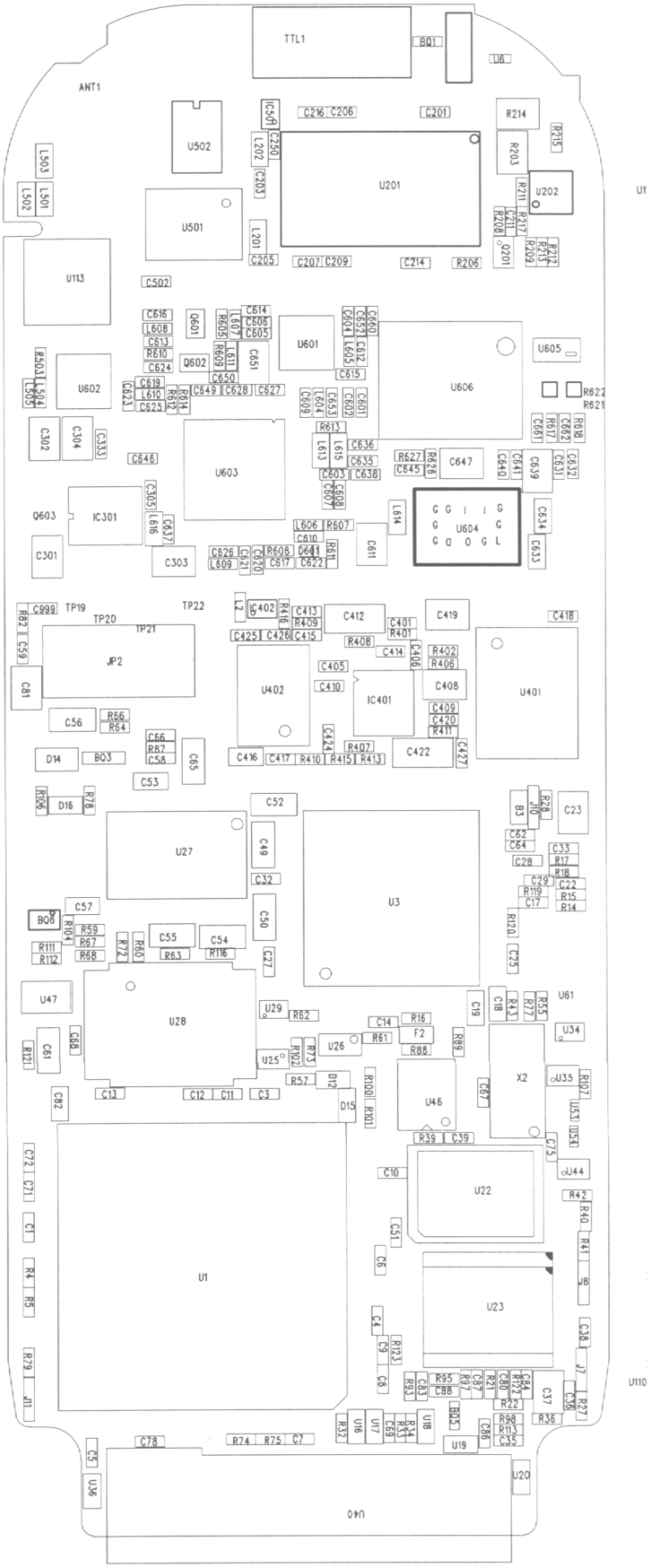
RX SIGNAL PATH
TX SIGNAL PATH
MAIN VCO SIGNAL PATH
TUNING VOLTAGES
REFERENCE CLOCK
Orderable Part
Non - Orderable Part

| | |
|---|---|
| GSM SERVICE SUPPORT GROUP | 01.01.11 |
| **LEVEL 3 RF Block Diagram** | Rev. 1.3 |
| Dual Band Topaz | |
| **Michael Hansen, Ray Collins, Ralf Lorenzen-Scheil** | Page 2 of 2 |

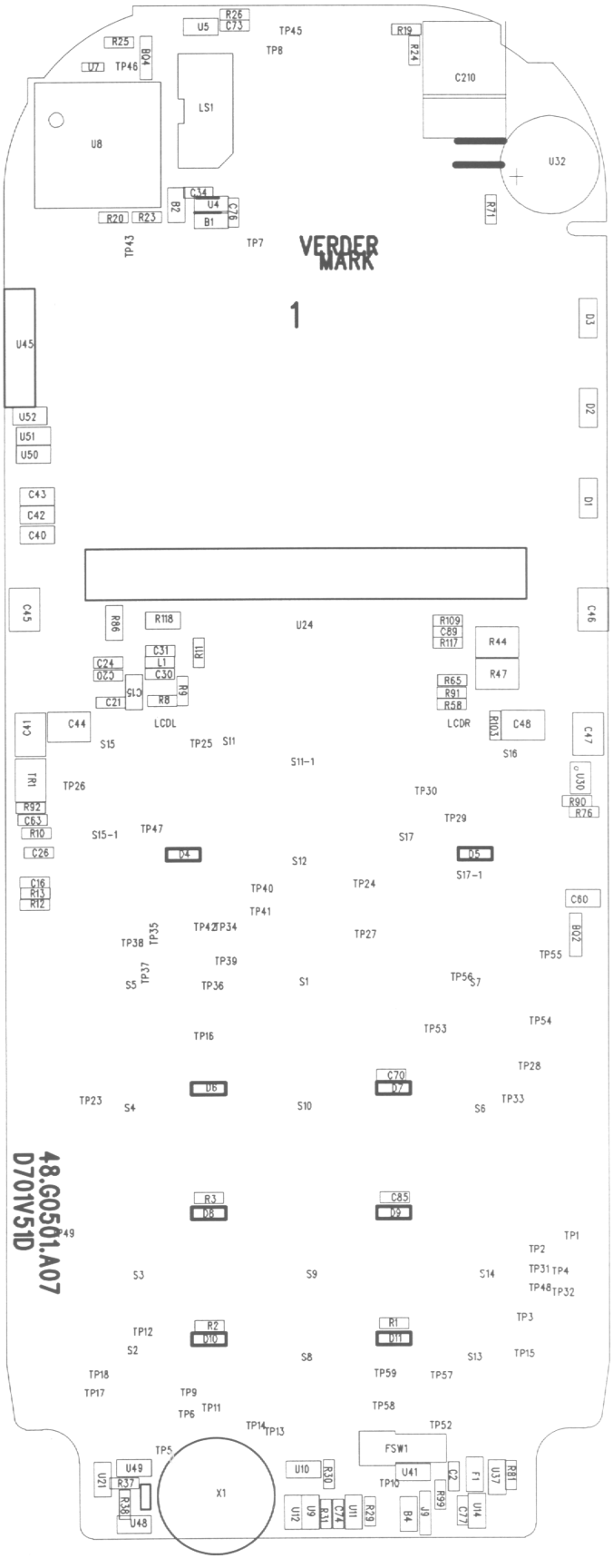

TTL1
BQ1
U6
ANT1
U502
U501
U201
U111
U113
U602
U601
U606
U605
U603
IC301
U604
U402
IC401
U401
JP2
U27
U3
U28
U47
U46
X2
U61
U1
U22
U23
U40
U110
L26:SILK TOP


VERDER MARK
1
48.60501.103
D701V7
U5
R26
C73
TP45
TP8
R19
R24
C210
U32
R25
B04
U7
TP46
LS1
U8
C34
U4
C76
B2
B1
R20
R23
TP43
TP7
R71
U45
U52
U51
U50
C43
C42
C40
C45
R86
R118
U24
R109
C89
R117
R44
R47
C31
L1
C30
C24
C20
C5
R9
R8
C21
R11
R65
R91
R58
LCDR
LCDL
C41
C44
C48
R103
S15
TP25
S11
S11-1
S16
TR1
TP26
TP30
R92
R76
C63
R10
C26
S15-1
TP47
TP29
S17
D4
D5
S12
S17-1
C16
R13
R12
TP40
TP24
TP41
C60
B02
TP38
TP35
TP42
TP34
TP27
TP55
TP39
TP37
S5
TP36
S1
TP56
S7
TP54
TP16
TP53
TP28
C70
D7
U6
TP23
S4
S10
S6
TP33
R3
D8
C85
D9
TP49
TP2
S3
S9
S14
TP31
TP4
TP48
TP32
TP3
TP12
R2
R1
D10
D11
S2
S8
S13
TP15
TP18
TP59
TP57
TP17
TP9
TP11
TP58
TP6
TP14
TP13
TP52
TP5
FSW1
U49
U10
R30
U41
C2
F1
U37
R81
U21
R37
TP10
X1
R38
U48
U12
U9
R31
C74
U11
R29
B4
J9
R99
C77
U14
TP1

L29:SILK BOT


TTL1
BQ1
U6
ANT1
U502
U201
U202
U501
U113
U602
U601
U606
U605
U603
IC301
U604
JP2
U402
IC401
U401
U27
U3
U28
U47
U46
X2
U22
U1
U23
U40
U36
U20
U19
U18
U17
U16
U61
U35
U34
U53
U51
U44
U25
U26
U29
U12
U110
U1

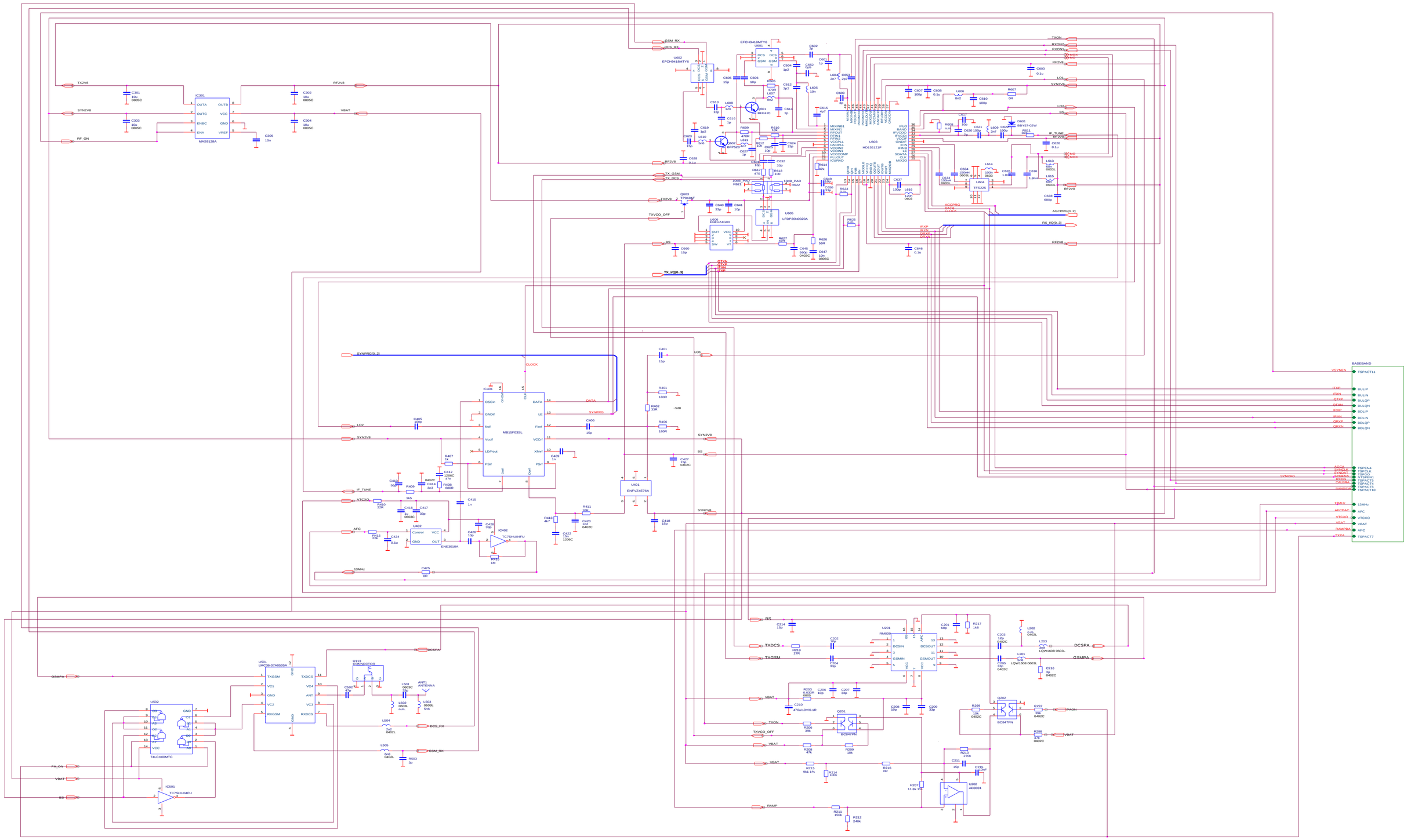
L26:SILK TOP


VERDER MARK
1
48.G0501.A07
D701V51D
U5
R26
C75
TP45
TP8
R19
R24
C210
R25
B04
U7
TP46
LS1
U8
U32
C34
B2
U4
C76
B1
R20
R23
R71
TP43
TP7
U45
U52
U51
U50
C43
C42
C40
D3
D2
D1
C45
C46
R86
R118
U24
R109
C89
R117
R44
R47
C31
L1
C30
R11
C24
C20
C15
R9
C21
R8
R65
R91
R58
LCDL
LCDR
R103
C48
C47
C41
C44
S15
TP25
S11
S11-1
S16
TR1
TP26
TP30
U30
R90
R76
R92
C63
R10
TP29
TP47
S15-1
S17
C26
D4
D5
S12
S17-1
C16
R13
R12
TP40
TP24
C80
TP41
B02
TP38
TP35
TP42
TP34
TP27
TP55
TP39
TP37
S5
TP36
S1
TP56
S7
TP54
TP53
TP16
C70
D7
TP28
D6
TP23
S4
S10
S6
TP33
R3
D8
C85
D9
TP1
TP49
TP2
TP31
TP4
S3
S9
S14
TP48
TP32
TP3
TP12
R2
D10
R1
D11
S2
S8
S13
TP15
TP18
TP59
TP57
TP17
TP9
TP11
TP58
TP6
TP14
TP13
TP52
TP5
FSW1
U21
U49
R37
R38
U48
X1
U10
R30
U41
TP10
G2
F1
U37
R81
U12
U9
R31
C74
U11
R23
B4
J9
R99
C77
U14

L29:SILK BOT

| Revisions | |
|---|---|
| GSM Service Support Group<br>L3 Audio Logic Schematic<br>Topaz | 5 Jan 01<br>Rev 1.0 |
| Rav Collins / Michael Hansen / Ralf Lorenzen-Schiel | |

GSM Service Support
Level 3 Authorized




GSM Service Support
Level 3 Authorized

| Revisions | |
|---|---|
| GSM Service Support Group<br>L3 RF Schematic<br>Topaz | 5 Jan 01<br>Rev 1.0 |
| Ray Collins / Michael Hansen / Ralf Lorenzen-Schiel | |

# Test Mode commands for Topaz T2688

1)*#300# OK List the Software and Hard ware version

2)*#301# OK Full Keypads functional Test

3)*#307# OK Engineering Test Mode

4)*#402# OK Adjust Display Intensity/ Contrast

5)*#403# OK List the Manufacturing Informations

6)1998 0722OK Master Unlock code for Phone and Sim Lock

7)*#302# OK Acoustic test*

1)greeting
2)Main VlmGain
3)Input Cal
4)Output Cal
5)Side In Gain
6)Vox Gain
7)Min Mic Engy
8)More
.1 In vlm Gain
.2 Aux Vlm Gain
.3 Silence Prd
.4 Supp Prd
.5 In Volume
.6 Out Volume
.7 Icon
.8 Image
.9 Animation

8)#303# OK Settings Saved*

**9)**#400# OK ADC, Cal val*

* use with care - contains cal factors